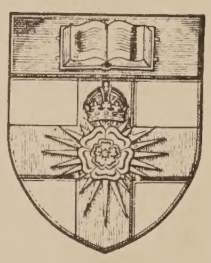
THIS BOOK
MUST NOT BE REMOVED
FROM THE LIBRARY

UNIVERSITY OF LONDON LIBRARY

REFERENCE ONLY



UNIVERSITY OF LONDON
LIBRARY

610992

REPORTS

FROM

COMMISSIONERS, INSPECTORS,

AND OTHERS:

FIFTY-ONE VOLUMES.

—(32.)—

LONDON TRAFFIC (ROYAL COMMISSION)—*continued.*

Session

13 *February* 1906 —— 21 *December* 1906.

VOL. XLV.

1906.

REPORTS

FROM

COMMISSIONERS, INSPECTORS,

AND OTHERS:

1906.

FIFTY-ONE VOLUMES:—CONTENTS OF THE

THIRTY-SECOND VOLUME.

N.B.—*THE* Figures *at the* beginning of the line, *correspond with the* N° *at the foot of each* Report ; *and the* Figures *at the* end of the line, *refer to the* Paging *of the Volumes arranged for The House of Commons.*

LONDON TRAFFIC (ROYAL COMMISSION):

[Cd. 2743.] Report to the Royal Commission on London Traffic by the Advisory Board of Engineers. Vol. VII. p. 1

BIBL. LOND... UNIV.

ROYAL COMMISSION ON LONDON TRAFFIC

Volume VII.

REPORT

TO THE

ROYAL COMMISSION ON LONDON TRAFFIC

BY THE

ADVISORY BOARD OF ENGINEERS.

Presented to both Houses of Parliament by Command of His Majesty.

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
By WYMAN and SONS, Limited, 109, Fetter Lane, E.C.

And to be purchased, either directly or through any Bookseller, from
WYMAN and SONS, Limited, 109, Fetter Lane, Fleet Street, E.C.; and
32, Abingdon Street, Westminster, S.W.; or
OLIVER and BOYD, Edinburgh; or
E. PONSONBY, 116, Grafton Street, Dublin.

1905.

[Cd. 2743.]

TABLE OF CONTENTS

OF

VOLUME VII.

	PAGE.
Prefatory Note as to the Volumes issued by the Royal Commission on London Traffic -	v
The Constitution of, and the Inquiry by, the Royal Commission on London Traffic - -	vii
The Appointment, and the Members of the Advisory Board of Engineers - - - -	ix
Terms of the Reference by the Royal Commission to the Advisory Board of Engineers for Report by the Board - - - - - - - - - - - - -	xi
Letter of Acknowledgment from the Chairman of the Royal Commission to the Chairman of the Advisory Board of Engineers on Receipt of the Board's Report - - -	xiii
Note in relation to the System of Marginal and other References in the Present Volume -	xv
Index to the Plans, Plates, Diagrams, Tables, etc., contained in the Report of the Advisory Board of Engineers, and the Appendix thereto - - - - - - - - -	xvii
Text of the Report to the Royal Commission by the Advisory Board of Engineers - -	1
Summarised Index to the Recommendations of the Advisory Board of Engineers and to the Portions of their Report Relevant thereto - - - - - - - - -	123
General Index to the Text of the Report of the Advisory Board of Engineers - - -	141

44. 1500.—Wt. 2075. 10/05. Wy. & S.

PREFATORY NOTE

AS TO THE

VOLUMES ISSUED

BY

THE ROYAL COMMISSION ON LONDON TRAFFIC.

The present volume is Volume VII of the eight volumes issued by the Royal Commission on London Traffic, and contains the Report to the Royal Commission by the Advisory Board of Engineers appointed by the Commission. (The Appendix to the Report of the Advisory Board of Engineers is Volume VIII.)

The other volumes issued by the Royal Commission on London Traffic, are:—

VOLUME I.—Report of the Royal Commission on London Traffic with Index and Plans.

VOLUME II.—Minutes of Evidence taken by the Royal Commission on London Traffic with Index and Digest.

VOLUME III.—Appendices to the Evidence taken by the Royal Commission on London Traffic with Index.

VOLUME IV.—Appendices to the Report of the Royal Commission on London Traffic with Index.

VOLUME V.—Maps and Diagrams furnished to, or prepared by, the Royal Commission on London Traffic with Index.

VOLUME VI.—Maps and Diagrams furnished to the Royal Commission on London Traffic with Index.

THE CONSTITUTION OF, AND THE INQUIRY

BY

THE ROYAL COMMISSION ON LONDON TRAFFIC.

The Commission, appointed on the 9th February, 1903, by Royal Warrant (*see* p. iii of Volume I.), consisted of:—

SIR DAVID MILLER BARBOUR, K.C.S.I., K.C.M.G., *Chairman.*

The Right Hon. Earl CAWDOR.
The Right Hon. Viscount COBHAM.
The Right Hon. Lord RIBBLESDALE.
The Right Hon. Sir JOSEPH COCKFIELD DIMSDALE, Bart., K.C.V.O., M.P.
Sir JOHN POYNDER DICKSON-POYNDER, Bart., D.S.O., M.P.
Sir ROBERT THRESHIE REID, G.C.M.G., K.C., M.P.
Sir JOHN WOLFE WOLFE-BARRY, K.C.B., F.R.S.
Sir FRANCIS JOHN STEPHENS HOPWOOD, K.C.B., C.M.G.
Sir GEORGE CHRISTOPHER TROUT BARTLEY, K.C.B., M.P.
Sir GEORGE STEGMANN GIBB.
Mr. CHARLES STEWART MURDOCH, C.B.
Mr. FELIX SCHUSTER.

Mr. LYNDEN MACASSEY, M.A., B.SC., LL.D., *Secretary.*

The Commission were commanded to inquire into the means of locomotion and transport in London, and to report:—

"(*a*) As to the measures which they deem most effectual for the improvement of the "same by the development and inter-connexion of Railways and Tramways on, or below, "the surface; by increasing the facilities for other forms of mechanical locomotion; by "better provision for the organization and regulation of vehicular and pedestrian traffic, or "otherwise.

"(*b*) As to the desirability of establishing some authority or tribunal to which all "schemes of Railway or Tramway construction of a local character should be referred, and "the powers which it would be advisable to confer upon such a body."

THE APPOINTMENT, AND THE MEMBERS OF THE ADVISORY BOARD OF ENGINEERS.

The Royal Commission appointed, on the 29th day of January, 1904, as an Advisory Board of Engineers:—

Sir JOHN WOLFE WOLFE-BARRY, K.C.B., LL.D., F.R.S.,
Past-President of the Institution of Civil Engineers, *Chairman*;

Sir BENJAMIN BAKER, K.C.B., K.C.M.G., LL.D., D.SC., M.A.I., F.R.S.,
Past-President of the Institution of Civil Engineers;

Mr. WILLIAM BARCLAY PARSONS, M.INST.C.E., MEM.AM.SOC.C.E.,
Chief Engineer to the Board of Rapid Transit Railroad Commissioners of the City of New York:

To report to the Royal Commission on the matters set forth on page xi. *et seq. infra.*

TERMS OF THE REFERENCE BY THE ROYAL COMMISSION TO THE ADVISORY BOARD OF ENGINEERS FOR REPORT BY THE BOARD.

The Royal Commission have been appointed to inquire into the means of locomotion and transport in London, and are required to report (*inter alia*)—

"(*a*) As to the measures which the Commission deem most effectual "for the improvement of the same by the development and "inter-connexion of Railways and Tramways on or below the "surface; by increasing the facilities for other forms of "mechanical locomotion; by better provision for the organisa- "tion and regulation of vehicular and pedestrian traffic or "otherwise."

For the purpose of carrying out these instructions the Commission desire to obtain expert and technical advice on the matters hereinafter referred to.

The said matters are for convenience arranged under the following heads:—Railways, Tramways, Streets, General.

Railways.

(*a*) The type and general direction of railways required, in addition to those already existing or authorised, for (1) connecting existing and authorised railways; and for (2) providing new routes for facilitating traffic in London and between London and the outlying districts.

(*b*) The cost of construction and the practicability in London of underground railways other than "tube" railways on the routes which have been suggested in evidence before the Commission or such other routes as may appear preferable.

Tramways.

(*a*) The extent to which tramways could practicably be laid down in London, for the purpose of providing additional facilities of rapid transit, (1) within London; (2) between the "Central Area" and the outskirts in one of the following, or partly in one, and partly in any of the others of the following systems:—(*a*) surface, (*b*) underground, (*c*) elevated.

(*b*) The connection of the tramway systems north and south of the river Thames.

The method of constructing "shallow" subways for railways or tramways with the least interference with the traffic on the streets affected thereby.

Evidence has been submitted to the Commission to the effect that, whilst railways in deep-level "tubes" and railways and tramways in "shallow" subways would be useful for journeys of some distance, say two or three miles, they would not be used to any substantial extent by short-distance passengers, and that, inasmuch as the vehicular traffic in crowded thoroughfares is largely composed of omnibuses and cabs carrying short-distance passengers, the construction of such "shallow" subways would not get rid of the congestion in main thoroughfares, and that it is only by the construction of surface tramways that rapid transit can be provided for short-distance passengers and a successful remedy applied to the existing congestion of traffic.

The Commission feel that it is impossible to arrive at any definite conclusion on this matter until they have before them detailed plans of "shallow" subways showing what means of ingress and egress can be provided.

It is obvious that for short distances a surface tramway is preferable to a tramway or railway in a subway, but the extent of the practical difference between them must depend upon the convenience of the arrangements which can be made for joining and leaving the cars in the subway, and the time necessarily occupied in descending and ascending.

The Commission therefore desire the Advisory Board of Engineers to prepare plans of the best types of "shallow" subways which they can devise for (*a*) a railway and (*b*) a tramway, including the approaches thereto, for the use of short-distance passengers.

The Commission also desire the Advisory Board of Engineers to examine carefully the suggestions of the London County Council, as submitted in evidence to the Commission, for a "shallow" subway from Hammersmith to the City.

Streets.

To consider and advise—

(*a*) As to the general directions in which new thoroughfares might best be made from the "Central Area" of London outwards, with cross streets to connect them, and with surface or other tramways and "shallow" subways for pipes beneath the surface.

(*b*) As to the extent to which the provision of secondary thoroughfares, parallel or adjacent to existing main thoroughfares, might usefully relieve a congestion of traffic.

(*c*) As to the proposals of Mr. Fitzmaurice, the Chief Engineer to the London County Council, in regard to the construction of new streets, contained in Appendix No. 9, Volume III., Plate XX., Vol. V., and to make such criticism thereon as may appear proper, especially as to the construction of a street according to type A, Plate XX., Vol. V., and the widening suggested by Mr. Fitzmaurice.

(*d*) As to the means of obviating obstruction caused by the crossing on the level of lines of vehicular and pedestrian traffic, by the construction of overbridges and subways or otherwise, and the cost thereof, with types of design.

(*e*) As to the means of obviating obstruction caused by undue standing of vehicles in thoroughfares, and for this purpose how far lay-bye yards, draw-in docks, or other similar methods, might be useful, with types of design.

(*f*) As to the practicability and cost of construction of subways for pipes, cables, etc., so as to prevent the frequent breaking up of streets.

General.

Generally to submit to the Commission any practical suggestions which the Advisory Board of Engineers may think it desirable to offer for dealing with the problems of locomotion and transport in London which are referred to the Commission, and to advise on any further matters which the Commission may from time to time refer to the Advisory Board of Engineers.

The Advisory Board of Engineers are requested, as far as practicable, carefully to avoid specifying any particular route in such a way as may tend to inflate the value of the land thereon by raising expectations that it may be taken for public purposes; in any case when specifying particular routes the advice given will be treated as confidential.

The Advisory Board of Engineers will not deal with nor report upon particular schemes that may be or may have been put forward by promoters in Parliament.

LETTER OF ACKNOWLEDGMENT FROM THE CHAIRMAN OF THE ROYAL COMMISSION TO THE CHAIRMAN OF THE ADVISORY BOARD OF ENGINEERS ON RECEIPT OF THE BOARD'S REPORT.

36, Great George Street,

Westminster, S.W.

27th June, 1905.

Sir,

In acknowledging the receipt of the Report of the Advisory Board of Engineers on certain matters connected with the question of locomotion in London referred to them by the Commission, I desire, in common with the other members of the Commission, to convey to yourself, to Sir Benjamin Baker, and to Mr. William Barclay Parsons, our thanks for the Report which the Board have prepared. This Report has not merely facilitated the work of the inquiry which the Commission has been conducting, but will prove of permanent value in guiding and directing future efforts to deal with the improvement of the means of locomotion and transport in London.

Along with the other members of the Commission I desire, also, to place on record our appreciation of your action in declining, on the ground that you were a member of the Commission, to receive any remuneration for the arduous duties of a professional nature which you undertook, in acting on and presiding over, the Advisory Board of Engineers.

I am, Sir,

Your obedient servant,

D. BARBOUR,

Chairman of the Royal Commission.

Sir John Wolfe-Barry, K.C.B., LL.D., F.R.S.,

Chairman of the Advisory Board of Engineers.

NOTE IN RELATION TO THE SYSTEM OF MARGINAL AND OTHER REFERENCES IN THE PRESENT VOLUME.

For the purpose of facilitating reference to plans, plates, diagrams, and tables, the following arrangement of type has been adopted in the inner margins of the pages of this volume, and also in the Index to the Plans, Plates, Diagrams, Tables, etc., on page .

1. Plans, except those with the title printed underlined, or in "italics," as the case may be, will be found in this volume.

2. Plans, with the title printed underlined, or in "italics," will be found in the Appendix (Volume VIII.).

3. Diagrams, except those with the title printed in "italics," will be found in this volume.

4. Diagrams with the title printed in "italics" will be found in the Appendix (Volume VIII.).

5. Tables, except those with the title printed in "italics," will be found in this volume. Tables in this volume are further distinguished by Roman numerals.

6. Tables with the title printed in "italics" will be found in the Appendix (Volume VIII.).

All Plates will be found in the present volume.

ILLUSTRATION OF METHOD.

Plan No. 1	is in Volume	VII.
Plan No. 2	„ „ „	VIII.
Diagram No. 1	„ „ „	VII.
Diagram No. 6	„ „ „	VIII.
Table I.	„ „ „	VII.
Table No. 1	„ „ „	VIII.

The exact position of the various Plans, Plates, Diagrams and Tables in Volumes VII. and VIII., together with the subject-matter thereof, appears in the Index to the Plans, Plates, Diagrams, Tables, etc., on p. xvii. of this Volume.

In addition there is prefixed to Volume VIII., the Appendix to this Volume, a complete Index to the Plans, Diagrams and Tables in it.

INDEX

TO THE

PLANS, PLATES, DIAGRAMS, TABLES, ETC.,

Contained in the Report of the Advisory Board of Engineers and the Appendix thereto, being Volumes VII. and VIII., respectively.

Plate, Plan, Diagram, or Table Number. (See Note on page xv. *supra.*)	Subject. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
Plan No. 1	Plan showing "Greater London," Scale 2 miles to an inch	1
Plan No. 2	*Map of Paris in the year 1793*	*1*
Plan No. 3	*Map of Paris in the year 1854*	*1*
Plan No. 4	*Map of Paris in the year 1871*	*1*
Plan No. 5	*Map of Paris in the year 1889*	*1*
Plan No. 6	Map of "Greater London," divided into 3 Zones and 5 Sections	14
Table VII.	Table of Population of London	13
Table VIII.	Table of Factories in the Administrative County of London	14
Table IX.	Table of Warehouses, Manufactories, Shops, &c., in the City of London in three classes of rateable value	15
	Goods Traffic.	
Plan No. 7	*Plan showing Railway and other Goods Stations and Receiving Offices in the "Central Goods Area" of London, and the routes followed by Railway Goods Vehicles*	*1*
Table No. 1 / Table X.	*Number of Vehicles arriving at and departing from the chief Railway Goods Stations in or near the "Central Goods Area" of London, between 7 a.m. and 8 p.m. on an ordinary Week-day*	16, *1*
Table No. 2	*Number of Goods Depôts and Parcels Receiving Offices belonging and auxiliary to the chief London Railway Companies and situated within the "Central Goods Area," together with the number of calls made Daily at each. Also number of Offices belonging to various Public Carriers, with the number of calls made Daily*	*5*
Table No. 3	*Number of Goods Vehicles arriving at and departing from the chief Railway Passenger Stations in or near the "Central Goods Area" of London, between 7 a.m. and 8 p.m. on an ordinary Week-day*	*7*

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See Note on page xv. *supra.*)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
	PASSENGER TRAFFIC TO "CENTRAL AREA."	
Table XII.	Census of persons entering City	18
Table No. 4	*Number of Passengers travelling by Railway, Tramway, and Omnibus to and from the "Central Area" of London during the whole of a typical Week-day*	*9*
DIAGRAM No. 1	Daily Passenger Traffic to "Central Area" (one direction only)	20
Table XIII.	Ditto - - - ditto - - - ditto	20
DIAGRAM No. 2	Daily Passenger Traffic from "Central Area" (one direction only)	22
Table XIV.	Ditto - - - ditto - - - ditto	21
DIAGRAM No. 3	Hourly Variation in Passenger Traffic to and from the "Central Area" by Railway, Tramway, and Omnibus, during the whole of a typical Week-day	24
Table XV.	Summary of Daily Passenger Traffic to "Central Area" (in one direction only)	22
Table XVI.	Summary of Daily Passenger Traffic from "Central Area" (in one direction only)	22
Table XVII.	Showing Approximate Total Local Yearly Passenger Traffic in "Greater London"	24
	SPEED OF VEHICLES. OMNIBUSES AND TRAMCARS.	
Table XVIII.	Speeds of Vehicles, Tramcars and Trains in the "Central Area" of London	24
Table No. 5	*Speeds of Horse Omnibuses*	*33*
Table No. 6	*Comparative Speeds of Horse and Motor Omnibuses*	*37*
Table No. 7	*Speeds of Cars on the London County Council, L.C.C. North Metropolitan Section, and London United Tramways*	*41*
Table XIX.	Speeds on certain other Electric Railways	25
Table XX.	Typical journeys from the Suburbs to the "Central Area" by Tramway, Railway, and Railway and Tramway	26
	STREETS.	
Table I.	Showing Expenditure on New Streets in Paris between 1871 and 1898	4
Table II.	Sums expended by chief public bodies in "Greater London" on Street Improvements	6
Table III.	Debt charge for Street Improvements, &c., borne by the County Rate for 1902–3	6
Table IV.	Showing amounts expended out of loans, to be repaid out of rates, towards New Streets, Widenings and Improvements since 1856 up to Session 1904 by the M.B.W. and L.C.C. in the several cities and boroughs in the County of London	7
Table V.	Showing Estimated Cost of Street Widenings and Improvements undertaken by Local Authorities in London since 1856	8

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See Note on page xv. *supra.*)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
Table VI.	Traffic in selected streets	11
Table XXI.	Showing widths of certain streets in London	30
Table XXII.	Showing widths of certain streets in Continental and other cities	31
Table XXIII.	Proposed widths of "Main Avenues" and new streets	33
Table XXIV.	Particulars of widths, buildings, gardens, forecourts, &c., in Euston and Marylebone Roads	39
Table XXVII.	Ditto ditto ditto Bayswater Road	43
Table XXVIII.	Ditto ditto ditto Kensington Road	43
Table XXIX.	Ditto ditto ditto Fulham and Brompton Roads	44
Table XXX.	Ditto ditto ditto King's Road, Chelsea	44
Table XXXII.	Showing widths of Old Kent Road and certain other streets	46
Table No. 8	*Widths of the main streets and bridges in London*	*45*
PLATE No. 1	Sketch showing suggested "Main Avenue." Cross Section	32
PLATE No. 2	Sketch showing suggested "First-class Arterial Street." Cross Section	33
PLATE No. 3	Sketch showing suggested "Main Avenue." Cross Section at Express Station	34
PLATE No. 4	Sketch showing suggested "Main Avenue." Cross Section at Local Station	35
PLATE No. 5	Sketch showing Four-track Subway, New York	36
Table XXV.	Showing particulars of traffic on Bayswater Road, Hammersmith Road, Fulham Road and King's Road	42
Table XXVI.	Showing widths of Bayswater Road, Hammersmith Road, Fulham Road and King's Road	42
Table XXXI.	Showing character of traffic on Bayswater Road, Hammersmith Road, Fulham Road and King's Road	45
Plan No. 8	Map showing suggested New Streets and Widenings	68
	NET AREAS REQUIRED FOR WIDENING CERTAIN STREETS.	
DIAGRAM No. 4	Net Areas of the various classes of Property required for Widening the Euston and Marylebone Roads to a width of 100 feet from King's Cross to Stafford Street	40
DIAGRAM No. 4A	Net Areas of the various classes of Property required for Widening the Bayswater Road to a width of 100 feet from the Uxbridge Road Station to Edgware Road	42
DIAGRAM No. 4B	Net Areas of the various classes of Property required for Widening the Kensington Road to a width of 100 feet from Hammersmith Broadway to Knightsbridge	44

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See Note on page xv. *supra*.)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics"*).	Page in Report, *or Appendix.*
DIAGRAM No. 4C -	Net Areas of the various classes of Property required for Widening the Fulham and Brompton Roads to a width of 100 feet from Fulham Palace Road to Knightsbridge - - - - - -	46
DIAGRAM No. 4D -	Net Areas of the various classes of Property required for Widening King's Road, Chelsea, to the width of 100 feet from Fulham High Street to Sloane Square - - - - - - - - -	48
	SHEPHERD'S BUSH TO WHITECHAPEL, AND HAMMERSMITH BROADWAY TO MANSION HOUSE STATION.	
DIAGRAM No. 5 -	Aggregate of Vehicular Traffic for one day of twelve hours, 8 a.m. till 8 p.m., on the two Main Routes of Shepherd's Bush to Whitechapel, and Hammersmith Broadway to Mansion House Station, divided into Passenger and Goods Vehicles - - - - - - -	58
DIAGRAM No. 5A -	Details of Vehicular Traffic for one day of twelve hours, 8 a.m. till 8 p.m., and during the "Busiest hour," on the Main Route from Shepherd's Bush to Whitechapel, together with the minimum widths of roadway - - - - - - - - - -	58
DIAGRAM No. 5B -	Details of Vehicular Traffic for one day of twelve hours, 8 a.m. till 8 p.m., and during the "Busiest hour," on the Main Route from Hammersmith Broadway to Mansion House Station, together with the minimum widths of roadway - - - - - -	58
	SHEPHERD'S BUSH TO WHITECHAPEL.	
Table XXXIII. -	Summary of Vehicular Traffic Counts, Shepherd's Bush to Whitechapel, for twelve hours - - - - - - - - - -	49
Table XXXIV. -	Ditto - - ditto - - ditto During "busiest hour" -	50
Table XXXV. -	Ditto - - ditto - - ditto For twelve hours - -	51
Table XXXVI. -	Ditto - - ditto - - ditto During "busiest hour" -	52
Table XXXVII. -	Summary of Vehicular Traffic Counts, from "Elephant and Castle" to Blackfriars Bridge - - - - - - - - - -	53
Table XXXVIII.	Summary of Vehicular Traffic Counts, Fulham Road and King's Road, Chelsea - - - - - - - - - - -	53
Table XXXIX. -	Showing Number of Vehicles using eight representative Crossings -	55
Table XL. - -	Summary showing Street Traffic divided into Goods and Passenger Vehicles on Shepherd's Bush to Whitechapel route - - -	57
Table XLI. -	Summary showing Street Traffic divided into Goods and Passenger Vehicles on Hammersmith Broadway to Mansion House route -	57
Table XLII. -	Traffic delays at different points - - - - - - - -	59
Table XLIII. -	Showing description of Vehicular Traffic at five crossings - -	61
Table No. 9 -	*Vehicular Traffic Count at Uxbridge Road Station, including Uxbridge Road, and Goldhawk Road* - - - - - -	*53*
Diagram No. 6 -	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*56*
Diagram No. 7 -	*Ditto - - ditto - - ditto Between 2 p.m. and 3 p.m.*	*56*
Table No. 10 -	*Vehicular Traffic Count in Uxbridge Road at Ladbroke Grove* -	*57*
Diagram No. 8 -	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*60*

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See Note on page xv. *supra.*)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
Table No. 11 -	*Vehicular Traffic Count at Notting Hill Gate Station, including Pembridge Road, and Silver Street* - - - - - - -	*61*
Diagram No. 9 -	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*66*
Table No. 12 -	*Vehicular Traffic Count in Bayswater Road at Queen's Road* -	*67*
Diagram No. 10	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*70*
Table No. 13 -	*Vehicular Traffic Count in Bayswater Road at Westbourne Street, and Victoria Gate* - - - - - - - - - - -	*71*
Diagram No. 11	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*76*
Table No. 14 -	*Vehicular Traffic Count at Marble Arch, including Bayswater Road, Edgware Road, Great Cumberland Place, Park Lane, and Hyde Park Gates* - - - - - - - - - - -	*77*
Diagram No. 12	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*92*
Diagram No. 13	*Ditto - - ditto - - ditto Between 6 p.m. and 7 p.m.*	*92*
Table No. 15 -	*Vehicular Traffic Count in Oxford Street at Orchard Street, and North Audley Street* - - - - - - - - - - -	*93*
Diagram No. 14	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*98*
Table No. 16 -	*Vehicular Traffic Count in Oxford Street at New Bond Street* -	*99*
Diagram No. 15	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*102*
Table No. 17 -	*Vehicular Traffic Count at Oxford (or Regent) Circus, including Oxford Street, Regent Street, and Great Portland Street* - -	*103*
Diagram No. 16	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*118*
Diagram No. 17	*Ditto - - ditto - - ditto Between noon and 1 p.m.*	*118*
Table No. 18 -	*Vehicular Traffic Count in Oxford Street at Wardour Street, and Berners Street* - - - - - - - - - - - -	*119*
Diagram No. 18	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*124*
Table No. 19 -	*Vehicular Traffic Count in Oxford Street at Tottenham Court Road, including Charing Cross Road, and High Street, Bloomsbury* -	*125*
Diagram No. 19	*Ditto - ditto - - ditto Between 8 a.m. and 8 p.m.*	*138*
Diagram No. 20	*Ditto - - ditto - - ditto Between 4 p.m. and 5 p.m.*	*138*
Table No. 20 -	*Vehicular Traffic Count in New Oxford Street at Bloomsbury Street, including Shaftesbury Avenue, Museum Street, Hart Street, Broad Street, and High Holborn* - - - - - - -	*139*
Diagram No. 21	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*152*
Table No. 21 -	*Vehicular Traffic Count in High Holborn at Red Lion Street* -	*153*
Diagram No. 22	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*156*
Table No. 22 -	*Vehicular Traffic Count in High Holborn at Chancery Lane, including Gray's Inn Road* - - - - - - - - -	*157*
Diagram No. 23	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*162*
Table No. 23 -	*Vehicular Traffic Count at Holborn Circus, including Hatton Garden, St. Andrew's Street, and Charterhouse Street* - -	*163*
Diagram No. 24	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*176*

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See Note on page xv. *supra.*)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
Table No. 24 -	*Vehicular Traffic Count in Holborn Viaduct at Old Bailey, and Giltspur Street* - - - - - - - - - - -	*177*
Diagram No. 25	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*182*
Table No. 25 -	*Vehicular Traffic Count at the General Post Office, including Newgate Street, St. Martin's le Grand, Cheapside, and St. Paul's Churchyard* - - - - - - - - - - - -	*183*
Diagram No. 26	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.* -	*198*
Diagram No. 27	*Ditto - - ditto - - ditto Between 10 a.m. and 11 a.m.*	*198*
Table No. 26 -	*Vehicular Traffic Count at the Bank, including King Street, Queen Street, Poultry, Queen Victoria Street, Mansion House Street, Princes Street, Threadneedle Street, Cornhill, and King William Street* - - - - - - - - - - - - -	*199*
DIAGRAM No. 28	Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.	54
DIAGRAM No. 29	Ditto - - ditto - - - ditto Between 11 a.m. and noon.	56
Diagram No. 28	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*228*
Diagram No. 29	*Ditto - - ditto - - ditto Between 11 a.m. and noon.*	*228*
Table No. 27 -	*Vehicular Traffic Count in Cornhill at Bishopsgate Street Within, including Leadenhall Street, and Gracechurch Street* - -	*229*
Diagram No. 30	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*242*
Diagram No. 31	*Ditto - - ditto - - ditto Between 11 a.m. and noon.*	*242*
Table No. 28 -	*Vehicular Traffic Count in Leadenhall Street at St. Mary Axe, and Lime Street* - - - - - - - - - -	*243*
Diagram No. 32	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*252*
Table No. 29 -	*Vehicular Traffic Count in Aldgate, including Leadenhall Street, Fenchurch Street, Jewry Street, Duke Street, Houndsditch, Minories, and Aldgate High Street* - - - - - - -	*253*
Diagram No. 33	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*282*
Diagram No. 34	*Ditto - - ditto - - ditto Between 11 a.m. and noon.*	*282*
Table No. 30 -	*Vehicular Traffic Count in Whitechapel High Street at Commercial Road East, including Commercial Street, and Leman Street* -	*283*
Diagram No. 35	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*308*
Diagram No. 36	*Ditto - - ditto - - ditto Between 11 a.m. and noon.*	*308*
	HAMMERSMITH BROADWAY TO MANSION HOUSE STATION.	
Table No. 31 -	*Vehicular Traffic Count at Hammersmith Broadway, including Brook Green Road, Beadon Road, King Street, Bridge Road, Queen Street, and Hammersmith Road* - - - - - -	*309*
Diagram No. 37	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*338*
Diagram No. 38	*Ditto - - ditto - - ditto Between 5 p.m. and 6 p.m.*	*338*
Table No. 32 -	*Vehicular Traffic Count in Kensington Road at Holland Road, and Warwick Road* - - - - - - - - - - -	*339*
Diagram No. 39	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*348*
Table No. 33 -	*Vehicular Traffic Count in Kensington Road at Earl's Court Road*	*349*
Diagram No. 40	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*352*

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See note on page xv. *supra*.)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
Table No. 34 -	*Vehicular Traffic Count in Kensington High Street at Church Street, and Kensington Palace Gardens* - - - - - -	*353*
Diagram No. 41	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*358*
Table No. 35 -	*Vehicular Traffic Count in Kensington Road at Palace Gate (Gloucester Road)* - - - - - - - - - -	*359*
Diagram No. 42	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*362*
Table No. 36 -	*Vehicular Traffic Count in Kensington Road at Queen's Gate* -	*363*
Diagram No. 43	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*368*
Table No. 37 -	*Vehicular Traffic Count in Kensington Road at Exhibition Road* - - - - - - - - - - -	*369*
Diagram No. 44	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*374*
Table No. 38 -	*Vehicular Traffic Count in Knightsbridge at Sloane Street, including Brompton Road* - - - - - - - - - -	*375*
Diagram No. 45	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*388*
Diagram No. 46	*Ditto - - ditto - - ditto Between 4 p.m. and 5 p.m.*	*388*
Table No. 39 -	*Vehicular Traffic Count at Hyde Park Corner, including Grosvenor Place, Hamilton Place, and Piccadilly* - - - - -	*389*
Diagram No. 47	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*406*
Diagram No. 48	*Ditto - - ditto - - ditto Between 4 p.m. and 5 p.m.*	*406*
Table No. 40 -	*Vehicular Traffic Count in Piccadilly at St. James's Street, including Berkeley Street, Dover Street, Albemarle Street, and Old Bond Street*	*407*
Diagram No. 49	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*426*
Diagram No. 50	*Ditto - - ditto - - ditto Between 4 p.m. and 5 p.m.*	*426*
Table No. 41 -	*Vehicular Traffic Count at Piccadilly Circus, including Piccadilly, Regent Street, Glasshouse Street, Shaftesbury Avenue, and Coventry Street* - - - - - - - - - -	*427*
Diagram No. 51	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*452*
Diagram No. 52	*Ditto - - ditto - - ditto Between 5 p.m. and 6 p.m.*	*452*
Table No. 42 -	*Vehicular Traffic Count at Waterloo Place, including Pall Mall, and Haymarket* - - - - - - - - - -	*453*
Diagram No. 53	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*460*
Table No. 43 -	*Vehicular Traffic Count at Charing Cross, including Cockspur Street, Trafalgar Square, Northumberland Avenue, West Strand, Duncannon Street, King William Street, and Bedford Street* -	*461*
Diagram No. 54	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*496*
Diagram No. 55	*Ditto - - ditto - - ditto Between 3 p.m. and 4 p.m.*	*496*
Table No. 44 -	*Vehicular Traffic Count in the Strand at Wellington Street* - -	*497*
Diagram No. 56	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*510*
Diagram No. 57	*Ditto - - ditto - - ditto Between 4 p.m. and 5 p.m.*	*510*
Table No. 45 -	*Vehicular Traffic Count in Fleet Street at Chancery Lane, including Fetter Lane* - - - - - - - - - -	*511*
Diagram No. 58	*Ditto - - ditto - - ditto Between 8 a.m. and 8 p.m.*	*516*

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM or TABLE NUMBER. (See note on page xv. *supra.*)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
Table No. 46	*Vehicular Traffic Count at Ludgate Circus, including Fleet Street, St. Bride Street, Farringdon Street, Ludgate Hill, and New Bridge Street*	*517*
Diagram No. 59	*Ditto ditto ditto Between 8 a.m. and 8 p.m.*	*530*
Diagram No. 60	*Ditto ditto ditto Between 9 a.m. and 10 a.m.*	*530*
Table No. 47	*Vehicular Traffic Count in St. Paul's Churchyard at Cannon Street*	*531*
Diagram No. 61	*Ditto ditto ditto Between 8 a.m. and 8 p.m.*	*534*
Table No. 48	*Vehicular Traffic Count at Mansion House Station, including Cannon Street, Queen Victoria Street, and Queen Street*	*535*
Diagram No. 62	*Ditto ditto ditto Between 8 a.m. and 8 p.m.*	*556*
Diagram No. 63	*Ditto ditto ditto Between 10 a.m. and 11 a.m.*	*556*
	"ELEPHANT AND CASTLE" TO BLACKFRIARS BRIDGE (NORTH END).	
Table No. 49	*Vehicular Traffic Count at the "Elephant and Castle," including St. George's Road, London Road, Newington Causeway, New Kent Road, Walworth Road, and Newington Butts*	*557*
Diagram No. 64	*Ditto ditto ditto Between 8 a.m. and 8 p.m.*	*586*
Diagram No. 65	*Ditto ditto ditto Between 5 p.m. and 6 p.m.*	*586*
Table No. 50	*Vehicular Traffic Count at South End of Blackfriars Bridge, including Stamford Street, Southwark Street, and Blackfriars Road*	*587*
Diagram No. 66	*Ditto ditto ditto Between 8 a.m. and 8 p.m.*	*600*
Diagram No. 67	*Ditto ditto ditto Between 10 a.m. and 11 a.m.*	*600*
Table No. 51	*Vehicular Traffic Count at North End of Blackfriars Bridge, including Victoria Embankment, New Bridge Street, and Queen Victoria Street*	*601*
Diagram No. 68	*Ditto ditto ditto Between 8 a.m. and 8 p.m.*	*614*
Diagram No. 69	*Ditto ditto ditto Between 10 a.m. and 11 a.m.*	*614*
	FULHAM ROAD AND KING'S ROAD, CHELSEA.	
Table No. 52	*Vehicular Traffic Count in Fulham Road at the Cancer Hospital*	*615*
Table No. 52	*Vehicular Traffic Count in Fulham Road at Stamford Bridge*	*618*
Table No. 53	*Vehicular Traffic Count in King's Road, Chelsea, at Sloane Square*	*621*
Table No. 53	*Vehicular Traffic Count in King's Road, Chelsea, at Beaufort Street*	*624*
	TRAFFIC DELAYS.	
Table No. 54	*Cross Traffic Delays at St. James's Street (junction with Piccadilly)*	*627*
Diagram No. 70	*Ditto ditto ditto ditto*	*628*
Table No. 55	*Cross Traffic Delays in the Strand at Wellington Street*	*629*
Diagram No. 71	*Ditto ditto ditto*	*630*

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See note on page xv. *supra.*)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
Table No. 56 -	*Cross Traffic Delays at Ludgate Circus* - - - - - - -	*631*
Diagram No. 72	*Ditto - - - ditto* - - - - - -	*632*
Table No. 57 -	*Cross Traffic Delays at the Bank* - - - - - - - -	*633*
DIAGRAM No. 73	Ditto - - - ditto. Sheets No. 1 and No. 2. - -	60
Diagram No. 73	*Ditto - - - ditto.* *Ditto* - - - -	*634*
	TRAMWAYS.	
Plan No. 9 and **Key Plan.**	Map showing the existing and authorised Tramways of "Greater London," and the suggested Surface and Subway Tramway Routes	88
Table XLIV. -	Showing route mileage of Tramways and Light Railways along public roads wholly or mainly within "Greater London," including all lines authorised during the Parliamentary Session of 1904 ("Northern and Eastern Section") - - - - - - - -	72
Table XLV. -	Ditto - - ditto - - ditto ("Southern Section") -	73
Table XLVI. -	Ditto - - ditto - - ditto ("Western Section") -	73
Table XLVII. -	Showing Summary of route mileage of Tramways and Light Railways along public roads wholly or mainly within "Greater London," including all lines authorised during the Parliamentary Session of 1904 ("Northern," "Eastern," "Southern" and "Western Sections") - - - - - - - - -	74
Table XLVIII. -	Showing number of Passengers alighting from and joining Tramway cars at the following Street Termini - - - - - - -	75
Table XLIX. -	Showing number of Cars run per hour to and from Westminster Bridge - - - - - - - - - - - -	78
Table L. - -	Traffic over Liverpool Tramways, 1897–1903 - - - - - -	86
Table LI. - -	Number of Vehicles of each class used on Liverpool Tramways -	86
DIAGRAM No. 74	Mileage of Tramways to Number of Inhabitants in Various Towns -	71
Table No. 58 -	*Statement of Route Mileage at and Number of Passengers carried during the year ending 30th June 1904, by Tramways and Light Railways (along public roads) wholly or mainly within "Greater London," including all lines authorised during the Parliamentary Session of 1904* - - - - - - - -	*635*
Table No. 59 -	*Statement of Passengers carried, Car Mileage, and Receipts on various Tramway Systems in "Greater London"* - - - -	*637*
Table No. 60 -	*Statement of the Average Number of Passengers per Car, over the whole of a Typical Day, arriving at the London Central Tramway Termini* - - - - - - - - - - -	*641*
Table No. 61 -	*Statement of Number of Cars, Seats, and Passengers Arriving at and Departing from the Tramway Termini within, or adjacent to, the "Central Area" of London, during the hour of maximum service traffic and during the whole of a typical Week-day* -	*643*
DIAGRAM No. 75	Showing Number of Passengers to and from various Railway and Tramway Termini on an average Week-day, arranged in order of most traffic. - - - - - - - - - - - -	75

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See note on page xv. *supra.*)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
DIAGRAM No. 76	Showing per capita journeys by Public Conveyance by Inhabitants of Various Towns, during one year	76
Diagram No. 77	*Existing Tramway Routes of "Greater London," supplied by the London County Council*	*644*
	LONDON COUNTY COUNCIL TRAMWAYS.	
Diagram No. 78	*Showing Daily Variation in Number of Passengers carried and Receipts for 1903, Average Variation due to Day of the Week, and Hourly Variation in Traffic and Receipts on a Fine Week-day, on London County Council Tramways south of the River Thames*	*644*
Table No. 62	*Showing Monthly Variation in Number of Passengers carried on the Routes terminating at Westminster Bridge, Blackfriars Bridge, Waterloo Station, and Hop Exchange (Borough), and Receipts for 1903, London County Council Tramways*	*645*
DIAGRAM No. 79	Ditto ditto ditto	72
Table No. 63	*Showing Hourly Variation in Terminal Traffic at Westminster Bridge, Blackfriars Bridge, Waterloo Station, and in Total Traffic at all Central Termini, London County Council Tramways*	*647*
DIAGRAM No. 80	Ditto ditto ditto	72
	LONDON COUNTY COUNCIL TRAMWAYS, NORTH METROPOLITAN SECTION.	
Diagram No. 81	*Showing Daily Variation in Number of Passengers carried and Receipts for 1903, Average Variation due to Day of the Week, and Hourly Variation in Traffic and Receipts on a Fine Week-day, on London County Council Tramways, North Metropolitan Section*	*650*
Table No 64	*Showing Monthly Variation in Number of Passengers carried on the Routes terminating at Moorgate, Aldgate, Holborn, and Euston Road, and Receipts for 1903, London County Council Tramways, North Metropolitan Section*	*651*
DIAGRAM No. 82	Ditto ditto ditto	73
Table No. 63	*Showing Hourly Variation in Terminal Traffic at Aldgate, Moorgate and Euston Road, and in Total Traffic at all Central Termini, London County Council Tramways, North Metropolitan Section*	*647*
DIAGRAM No. 83	Ditto ditto ditto	73
	LONDON UNITED TRAMWAYS.	
Diagram No. 84	*Showing Daily Variation in Number of Passengers carried and Receipts for 1903, Average Variation due to Day of the Week, and Hourly Variation in Traffic and Receipts on a Fine Week-day, on London United Tramways*	*652*
Table No. 65	*Showing Monthly Variation in Number of Passengers carried on the Routes terminating at Shepherd's Bush and Hammersmith, and Receipts for 1903, London United Tramways*	*653*
DIAGRAM No. 85	Ditto ditto ditto	74

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See note on page xv. *supra*.)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
Table No. 63	*Showing Hourly Variation in Terminal Traffic at Shepherd's Bush and Hammersmith Termini, and Total, London United Tramways*	*647*
DIAGRAM No. 86	Ditto ditto ditto	74
	PLANS SHOWING NATURE OF EXISTING FRONTAGES.	
Plan No. 10	Suggested Surface Tramway Route, No. 2 (Kensington Road). Sheets No. 1 and No. 2	80
Plan No. 11	Suggested Surface Tramway Route No. 4 (Fulham and Brompton Roads). Sheets No. 1 and No. 2	80
Plan No. 12	*Suggested Surface Tramway Route No. 6 (Edgware Road). Sheets No. 1 and No. 2*	*654*
Plan No. 13	*Suggested Surface Tramway Route No. 7 (Harrow Road)*	*654*
Plan No. 14	*Suggested Surface Tramway Route No. 8 (Cambridge Avenue)*	*654*
Plan No. 15	Suggested Surface Tramway Route No. 9 (Bayswater Road). Sheets No. 1 and No. 2	82
Plan No. 16	*Suggested Surface Tramway Route No. 15 (York Road and Stamford Street)*	*654*
Plan No. 17	*Suggested Surface Tramway Route No. 18 (Liverpool Street)*	*654*
Plan No. 18	Suggested Surface Tramway Route No. 20 (King's Road, Chelsea). Sheets No. 1 and No. 2	82
Plan No. 19	Suggested Surface Tramway Route No. 22 (Euston and Marylebone Roads). Sheets No. 1 and No. 2	84
Plan No. 20	Suggested Surface Tramway Route No. 23 (Finchley Road). Sheets No. 1 and No. 2	84
	OMNIBUS ROUTES.	
DIAGRAM No. 87 (Plate VIII., Vol. V.)	Existing Omnibus Routes, supplied by the London County Council. (See Plate VIII., Vol. V.)	
	RAILWAYS.	
Plan No. 21	Map showing the existing and authorised Main-Line, Suburban and Urban Railways of "Greater London"	138
DIAGRAM No. 75	Showing Number of Passengers to and from various Railway and Tramway Termini on an average Week-day, arranged in order of most traffic	75
Table No. 66	*Showing the Number of Passenger Journeys to and from Stations of a Terminal character within the "Central Area" of London during the Year 1903*	*655*

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See note on page xv. *supra*.)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
DIAGRAM No. 88	Showing Number of Passengers to and from various Railway Termini during one Year, arranged in order of most traffic	91
Table No. 67	*Showing Hourly Variation in Passenger Traffic at Stations of a Terminal character within the "Central Area" of London on an average Week-day*	*657*
DIAGRAM No. 89	Showing Passenger Traffic at Stations of a Terminal character within the "Central Area" of London, "Western Section," hour by hour, on an average Week-day	92
DIAGRAM No. 90	Ditto "Northern Section" ditto	93
DIAGRAM No. 91	Ditto "Eastern Section" ditto	94
DIAGRAM No. 92	Ditto "South-Eastern Section" ditto	95
DIAGRAM No. 93	Ditto "South-Western Section" ditto	96
Table LII.	Showing the Mileage and Length of Single Road used by Passenger Trains within the area of "Greater London" of the various railway companies	99
Table LIII.	Showing the Mileage, Length of Single Road used by Passenger Trains, and number of Stations of the various Railways within the five sections of "Greater London," together with the area and population of each section	100
Table LIV.	Showing "Tube" Railways authorised and in course of construction	100
Table LV.	Showing "Tube" Railways and extensions authorised but not yet commenced	100
Table LVI.	Showing Railway Accommodation in each section in order of priority	101
Table LVII.	Cost of Underground Railways for a double line of rails, including stations	106
Table LVIII.	Ditto "Tube" Railways ditto	107
Table LIX.	Ditto Tramway Subways ditto	107
	METROPOLITAN AND METROPOLITAN DISTRICT RAILWAYS.	
Table No. 68	*Showing the Number of Passenger Journeys to and from various Stations on the Metropolitan and Metropolitan District Railways, during the Year 1903*	*661*
Table No. 69	*Showing Hourly Variation in Passenger Traffic at various Stations on the Metropolitan and Metropolitan District Railways during the whole of an average Week-day*	*663*
DIAGRAM No. 94	Showing Passenger Traffic at various Stations on the Metropolitan and Metropolitan District Railways, Hour by Hour, during the whole of an average Week-day	97
	CITY AND SOUTH LONDON RAILWAY.	
Table No. 70	*Showing the Number of Passengers Entering and Leaving various Stations, on the City and South London Railway, each Hour for one complete Day*	*667*

INDEX TO PLANS, ETC.

PLATE, PLAN, DIAGRAM, or TABLE NUMBER. (See note on page xv. *supra.*)	SUBJECT. (If in this volume, in ordinary type; *if in the Appendix, Volume VIII., in "italics."*)	Page in Report, *or Appendix.*
Table No. 71 -	*Showing the Number of Passengers booked to and from all Stations on the City and South London Railway during an ordinary Week-day, with Number of Season Ticket Holders added in "Italics"* - - - - - - - - - - - -	*671*
Diagram No. 95	*Showing the Number of Passengers travelling between each Station on the Up and Down Lines respectively of the City and South London Railway, during the whole of, and from 8 a.m. till 10 a.m. on, an ordinary Week-day. Also showing separately the through traffic between Clapham Common, Clapham Road and Stockwell, and Old Street, City Road and Angel, for the same periods* - - - - - - - - - -	*674*
DIAGRAM No. 96	Showing the Number of Passengers departing from and arriving at each Station by train on the City and South London Railway, during an ordinary Week-day - - - - - - - -	98
DIAGRAM No. 97	Showing Passenger Traffic at various Stations on the Central London and City and South London Railways, Hour by Hour, during the whole of an average Week-day - - - - - - -	99
	CENTRAL LONDON RAILWAY.	
Table No. 70 -	*Showing the Number of Passengers Entering and Leaving various Stations on the Central London Railway each Hour for one complete Day* - - - - - - - - - - -	*667*
DIAGRAM No. 97 -	Showing Passenger Traffic at various Stations on the Central London and City and South London Railways, Hour by Hour, during the whole of an average Week-day - - - - - - - -	99
DIAGRAM No. 98 -	Showing the Number of Passengers Departing from and Arriving at each Station by Train on the Central London Railway, during an ordinary Week-day - - - - - - - - - -	100
	WATERLOO AND CITY RAILWAY.	
Table No. 70 -	*Showing the Number of Passengers on the Waterloo and City Railway, each Hour for one complete Day* - - - - -	*667*
DIAGRAM No. 99 -	Showing Passenger Traffic at various Stations on the Great Northern and City and Waterloo and City Railways, Hour by Hour, during the whole of an average Week-day - - - - - - -	101
	GREAT NORTHERN AND CITY RAILWAY.	
Table No. 70 -	*Showing the Number of Passengers Entering and Leaving various Stations on the Great Northern and City Railway each Hour for one complete Day* - - - - - - - - - -	*667*
DIAGRAM No. 99 -	Showing Passenger Traffic at various Stations on the Great Northern and City and Waterloo and City Railways, Hour by Hour, during the whole of an average Week-day - - - - - - -	101
	LOSS CAUSED BY WANT OF TRAVELLING FACILITIES.	
MEMORANDUM -	*Memorandum by Sir John Wolfe-Barry, K.C.B., and Mr. R. C. H. Davison, M.Inst.C.E., on the loss caused to inhabitants by want of proper travelling facilities* - - - - - - - -	*675*

REPORT

OF THE

ADVISORY BOARD OF ENGINEERS.

REPORT

TO

THE ROYAL COMMISSION ON LONDON TRAFFIC

BY

THE ADVISORY BOARD OF ENGINEERS.

To the Chairman of the Royal Commission on London Traffic,

Sir,

In the study of the traffic problems of London, the Advisory Board has become deeply impressed with the seriousness of the situation, the sad neglect in the past of taking proper precautions for the future, and the radical and expensive steps which ought now to be taken, if it be really intended to furnish the Metropolis with a proper measure of facilities for its citizens to move about within its borders and to conduct their daily avocations with reasonable economy and dispatch. In these respects London is already inferior to other cities in the United Kingdom, and a long way behind the capitals and great commercial centres in foreign countries. General condition of traffic.

PRELIMINARY.

The prime cause of London's backwardness is to be found in the lack of homogeneity in its municipal system, and an entire absence of any centralised control and of consequent guiding effort which such control ensures.

The aggregation to which the name of London, regardless of municipal boundaries, has been applied, started from a central origin in what was and still officially remains the City of London, and has been spreading in all directions, covering over, but unfortunately not absorbing the various cities, towns, villages and parishes which in former times, as separate units, surrounded the City. What, therefore, is popularly called "Greater London" to-day, is the Metropolitan Police District, together with the City of London, and embraces an area of approximately 693 square miles, as against the one square mile which still constitutes the City of London proper, and the 116 square miles of the County of London. (*See* Plan No. 1 facing this page). Expansion of London.

Plan No. 1

During the many years, centuries in fact, in which this process of spreading has continued, some partial effort has been made towards the Efforts at unification.

unification of the component parts and the elimination of the disconnected and separate local authorities. Even now, the police force of "Greater London" is divided into two parts, one of which is under the control of one of the constituent authorities of London's government, while the remainder is directly under the Home Department.

Creation of Metropolitan Board of Works and London County Council.

The greatest single advance in unification was the creation of the Metropolitan Board of Works in 1856, and of their successors the London County Council in 1889, with jurisdiction in relation to sanitary and other matters over the area as a whole, now constituting the Administrative County of London. But so far as the various municipal authorities are concerned, especially with respect to matters of traffic within their boundaries, their existence and powers have been protected and preserved with an almost religious zeal.

Number of authorities.

Thus, the control of municipal matters in the Administrative County of London is vested in and divided among thirty corporations and municipal bodies, which are quite independent of each other in most matters, though inter-dependent in some, viz.: the London County Council, the Corporation of the City of London, the Council of the City of Westminster, and the Metropolitan Borough Councils of—

Battersea	Hackney	Poplar
Bermondsey	Hammersmith	St. Marylebone
Bethnal Green	Hampstead	St. Pancras
Camberwell	Holborn	Shoreditch
Chelsea	Islington	Southwark
Deptford	Kensington	Stepney
Finsbury	Lambeth	Stoke Newington
Fulham	Lewisham	Wandsworth
Greenwich	Paddington	Woolwich

Streets planned to meet local needs alone.

In respect of the provision of new or improved thoroughfares, until about fifty years ago, these authorities or their predecessors, the vestries and district boards, were, as a rule, entirely independent, and, in consequence, there has been little or no correlation of design or intention. Streets were planned and laid out with regard to local needs—without apparent thought of making any new or widened street an extension or component part of a street in an adjoining parish or district, and without considering that a street in a city has not only to fulfil its functions as a local highway, but should also act as a thoroughfare, connecting adjoining districts, and that consequently it should be made of such proportions as to bear the double burden of local and through traffic, with ample provision for the increasing demands of the future.

Local authorities of "Greater London."

When we go further afield and consider "Greater London," which may be further defined to include every parish the whole of which is within a radius of fifteen miles and any part of which is within a radius of twelve miles of Charing Cross, the anomaly of the situation is further accentuated. Here we find, in addition to the London County Council and the twenty-nine corporations and municipal bodies above mentioned, five other county councils, with various constituent borough corporations and district councils. The county councils are those of the Administrative Counties of Middlesex, Surrey, Kent, Essex, and Hertfordshire, all of which, except the last named, abut on the area of the London County Council.

Highway authorities of "Greater London"

We therefore have, for the whole of "Greater London," something like 106 highway authorities,[1] without any central authority to advise or guide them, or to see that the important duties entrusted to them are carried out efficiently.

Boundaries between counties and other areas.

The boundaries between the administrative counties, as between other local areas, are irregular in the extreme, so that we find in a main thoroughfare one side of the street situated in the Administrative County of London

[1] Mr. W. Rees Jeffreys, Q. 18072, Vol. II.

and the other side in another administrative county. Outside the Administrative County of London the centre of the Thames is the county boundary, so that half of a bridge across the metropolitan river, if that bridge is outside the Administrative County of London, is within one county jurisdiction and the other half in another.

Prejudicial result of present anomalies.

It is useless to multiply examples of these anomalies, and we only allude to them here in order to point out that they produce most serious difficulties in the way of carrying into effect any comprehensive proposals for the welfare of the area of "Greater London" considered as a whole in regard to locomotion.

System in other cities.

There are other cities where somewhat similar conditions have existed, but they have been met, either by centralising the component local governments, or by realising that street and traffic questions are matters of common interest to the whole community, and by placing the control of such matters in the hands of a single body. Nor have other municipalities hesitated to face great expense and adopt almost heroic measures in order to bring themselves up to modern standards and requirements.

Policy in Paris, Vienna, Berlin, Brussels, Buda-Pesth, Rome, New York and Boston.

For example, Paris has, during the latter half of the nineteenth century, constructed its system of new boulevards and avenues and has lately made a complete underground railway, leased on a profit-sharing plan to a private company. Vienna, Berlin, Brussels, Buda-Pesth, Rome, and other European cities have, of late years, remodelled their streets, while New York and Boston have not only laid out new streets and widened old ones, but have not hesitated to assist private enterprise by placing municipal credit behind extensive railway projects. This policy has in every instance proved successful either directly or indirectly.

Improvements in Paris since 1793.

By the courtesy of the Prefect of the Seine, we are enabled to include in the Appendix to this report four very interesting plans (Plans Nos. 2, 3, 4 and 5, Volume VIII.) of Paris, on which are indicated the improvements of that city from the year 1793 till 1889.

It appears that in 1793 a Commission of Artists laid down the various improvements which then seemed to be desirable, and these are shown on the plan (Plan No. 2, Volume VIII.) of that date.

Plan No. 2.

Plan No. 3.

The plan of 1854 (Plan No. 3, Volume VIII.) indicates that from 1793 up till 1854 the intentions of the former date were gradually and systematically carried out.

In 1854, M. Haussmann was appointed Prefect of the Seine, and laid down the magnificent series of street improvements with which his name has ever since been connected. They were commenced in 1858 by the construction of the Boulevard Sebastopol, and the plan of 1871 (Plan No. 4, Volume VIII.) shows that, up till that date, most of those improvements had been effected.

Plan No. 4.

In 1871, in the fire of the Hôtel de Ville, the plans of M. Haussmann were burnt with all relative documents, but the plan marked 1871 was officially compiled from the best information obtainable, and may be taken to represent the projects of M. Haussmann.

From 1871 till 1889, such as were known of M. Haussmann's proposals that had not been carried out, together with certain important additions, were executed. Thus, the plan of 1889 (Plan No. 5, Volume VIII.) may be looked upon as more or less representing the achievement of the various carefully thought-out improvements since the matter was first broached in 1793 and again considered in 1854.

Plan No. 5.

Paris remodelled during nineteenth century.

It will thus be seen that during the nineteenth century large areas of Paris have been remodelled and rebuilt on systematic plans, and that carefully thought-out arterial streets have been pierced in various directions.

Expenditure on new streets in Paris since 1871.

The expenditure on new streets in Paris prior to 1871 is probably unknown, owing to the fire of 1871. Between 1871 and 1898, both years

inclusive, the expenditure on new streets appears to have been £24,772,000, or an average of £884,714 per annum as will be seen from the following Table :—

TABLE I.

EXPENDITURE ON NEW STREETS IN PARIS BETWEEN 1871 AND 1898.

Year.	Expenditure in £.	Year.	Expenditure in £.	Year.	Expenditure in £.	Year.	Expenditure in £.	Year.	Expenditure in £.
1871	525,061	1877	794,343	1883	1,046,306	1889	952,006	1895	1,077,408
1872	580,944	1878	813,887	1884	1,088,854	1890	967,111	1896	1,104,441
1873	499,703	1879	792,225	1885	964,614	1891	969,076	1897	1,150,237
1874	523,126	1880	817,882	1886	898,924	1892	998,995	1898	1,087,515
1875	530,804	1881	955,304	1887	875,171	1893	1,114,750		
1876	643,770	1882	975,134	1888	961,126	1894	1,063,317	Total	£24,772,034

Comparison of widths of streets, Paris and London.

The scale on which the new streets of Paris were conceived 50 years ago is far superior to anything we know of in London at the present moment, both as to length and width. Whereas we made the Shaftesbury Avenue, in 1887, 60 feet wide, and, even in 1900, have only adopted 80 feet as the width of such a thoroughfare as the Strand, the French as long ago as 1854 adopted a width of 98 feet 6 inches for the Boulevard de Sébastopol, Boulevard Haussmann, and the Avenue de l'Opéra, and 118 feet for most of the streets converging on the Arc de Triomphe.

Result of defined ideas.

The result, which is the admiration of the world, is a remarkable example of the gradual realisation of complete conceptions, and is evidence of the great importance to a city, of defined ideas of what is necessary, not only for the present but for the future, which can be gradually carried out as opportunity and financial ability will allow.

Want of a comprehensive plan for London.

In London, on the other hand, no comprehensive plan of improvements has been made, so far as we know, since Sir Christopher Wren's plan for rebuilding the City of London after the fire in 1666, and this fine project was unfortunately ignored.

London improvements isolated efforts.

The improvements that have been undertaken in London during the past fifty years have been more in the nature of isolated efforts, such as the Thames Embankments, Holborn Viaduct, Northumberland Avenue, Kingsway, and others. These improvements, while all essentially necessary, and of much benefit locally, have not added materially to the solution of the general problem, namely, the betterment of the traffic conditions of London as a whole. Other improvements of equal or even greater importance, such as the widening of the Strand and the union of The Mall with Charing Cross, have either stopped short of completion, or are proceeding with regrettable slowness. The increase of facilities for locomotion through the Strand and Fleet Street, so urgently needed in those great thoroughfares, appears to be still, by very many years, short of completion.

Want of method the result of the present system.

In making these remarks, we wish it to be understood that they are not made in adverse criticism of persons or of public bodies. We realise that, under the present system, such want of method and consequent delay are inevitable. We desire, however, to point out the facts as we find them, and to call the attention of the Royal Commission to them as being, in our opinion, subjects requiring urgent attention. The salient fact remains that London, in the way of general improvements of thoroughfares, for the benefit of the whole community, has not kept pace with other cities either at home or abroad.

Questions considered in the broadest way.

We have therefore considered the questions submitted to us in the broadest way. Having taken into account London's lack of forethought in the past, we have endeavoured to estimate its present needs, and we now beg leave to suggest, in general terms, the main lines of improvements we consider necessary, if London is to be equipped with proper and convenient means of quick transit from one part to the other.

Loss caused by want of travelling facilities.

We cannot but think that unless this be done London will have to conduct its business at a disadvantage compared with other cities, in this and other countries, and we are also convinced that a startling amount

of money is annually wasted in London from lack of travelling facilities. It should also be observed that such pecuniary losses fall, not so much on the rich or even on the professional members of the community, as on, what are usually called the "working classes," to whom, in a peculiar and more urgent sense, time is money. These have not only to traverse the crowded streets of the Metropolis by slow and antiquated means of locomotion, but are also severely handicapped every day by inconvenient communication with external London, and the suburbs where, for many reasons, it is desirable that a large proportion of them should live. They are thus compelled to lose their time, which is usually their only asset, and a serious addition is made to the stress of their daily life.

Memorandum by Sir John Wolfe-Barry and Mr. R. C. H. Davison.

The extent to which the want of good travelling facilities affects the earning power of the inhabitants of London is one very difficult of demonstration, however approximately. Sir John Wolfe-Barry and Mr. R. C. H. Davison have given attention to this subject, and have prepared a memorandum upon it, which is given at page 675 of the Appendix (Volume VIII.). Their memorandum does not profess to arrive at an estimate of the loss sustained by London from deficient means of locomotion, and its value consists in indicating the magnitude of the money interests involved. The largeness of the money at stake, from the point of view in question, demands consideration.

Financial considerations not dealt with in detail.

We have not attempted to deal in detail with, or to limit ourselves by, strictly financial considerations arising out of the improvements to which we shall invite attention, nor have we attempted to show that they will, in themselves, furnish a sufficiently direct revenue to repay the original outlay. Many of the schemes proposed, such as the main lines of tramway and of railway extensions, can, if treated in a liberal manner, and on commercial principles, by the municipal authorities, be made remunerative. Others of the improvements, such as the new streets, can possibly, by judicious planning and by the purchase of suitable lands, be made to "recoup" the debt, wholly or in part, either by the sale of improved ground rents, or by a leasing of some of the new facilities in the way of tramways or subways, constructed upon or beneath, the streets.

In the case before us, the expenditure involved should primarily be considered from the point of view of the benefits to be secured by the provision for a greater traffic than the present streets can carry, and the saving of time to every citizen. In addition, and as a consequence, there would be an increase in the value of property generally, and higher assessments would result from such increase in values.

Authorities should take up matter boldly.

We accordingly believe the problem ought to be thus considered, and that the responsible authorities should be prepared to take up the matter boldly, and be ready to face as great an expenditure as a conservative wisdom and a courageous belief in the future will justify.

Improvements will be costly.

The improvements that we suggest will, no matter how carefully financed, be costly. It must not be forgotten, however, that other cities have successfully faced similar difficulties. When the area, population, commerce, and wealth of London are compared with those of other great cities, we believe that the public burden of carrying out the schemes proposed will be found to be lighter in proportion than that undertaken by other communities.

How foreign cities meet expenditure.

In the case of the foreign cities to which we have referred, the incidence of cost has been gradual, and has, generally speaking, been largely met by "*octroi*" or other indirect sources of revenue, which do not now exist in London. To such sources of revenue foreigners and non-residents contribute largely, as well as the resident population. It is not for us to suggest how the large sums required for London improvements are to be raised, but we think we may point out that the process of delaying improvements, and executing such as have been undertaken in an inadequate manner, has involved the present generation in, what may almost be called, a crisis, and that wholesale postponement will inevitably result in larger future expenditure if London is ever to possess the advantages of other cities of less wealth and commercial importance. The great works which we think are required need not, of course, be executed with undue rapidity, but the essential matter is to grasp at the outset what is necessary, and to lay down comprehensive plans which can be worked at systematically and with perseverance.

Amount spent by railway and tramway companies compared with expenditure on streets.

From these points of view, a sum of money may be well spent which seems at first sight very large. The railway and tramway companies have probably expended during the past twenty years for the accommodation of London traffic some £100,000,000, or an average of £5,000,000 per annum. The public authorities have spent on arterial streets a comparatively small sum, as may be seen by the following table; and they are receiving from rates on the traffic carried by the companies very large sums annually.

From figures laid before us we find that, during the past fifteen years, the following approximate sums have been expended, out of the funds at their disposal, by the chief public bodies responsible for such matters within the limits of "Greater London" on street improvements, new bridges, and widenings.

TABLE II.

	£
London County Council	6,293,509
Corporation of the City of London	1,034,270
The Councils of the City of Westminster and the other Metropolitan Boroughs and their predecessors, the vestries and district boards	779,679
Middlesex County Council	339,706
Surrey County Council	146,257
Kent County Council	No information.
Essex County Council	No information.
Hertfordshire County Council	3,000
Corporation of West Ham	500,000
	£9,096,421

Or an average of £606,428 per annum.

In addition to the above expenditure by the City of London, £1,394,000 has been spent by the Bridge House Estates Trust on bridges, including £1,293,991 on the Tower Bridge. The Bridge House Estates Trust also pay the annual cost of working the Tower Bridge which amounts to a considerable sum.

From information prepared by the London County Council, we are able to give the following statement, showing the actual charge upon the rates for the year 1902-3 (the latest for which figures are available) in respect of street improvements, &c., undertaken by the London County Council and its predecessor, the Metropolitan Board of Works, within the Administrative County of London :—

TABLE III.

DEBT CHARGE FOR STREET IMPROVEMENTS, &C., BORNE BY THE COUNTY RATE FOR THE YEAR 1902-3.

	£
Street Improvements	431,213
Bridges	104,417
Tunnels	64,269
Embankments	50,469
Woolwich Ferry	9,153
	£659,521

The sums consist of the charges for interest on, and repayment of, the debt incurred in carrying out these works. The total amount was £659,521, and the amount included in the County Rate in respect of this was equivalent to 3·94*d.* in the £ on the assessable value in April, 1902.

The amounts expended upon the same class of improvements by the London County Council or its predecessors, in the several Cities and Boroughs within the Administrative County of London, for the past 48 years, are shown in the first of the following tables, together with the present and average rateable values, and equivalent rates per £ of the different districts.

TABLE IV.

Amounts expended out of loans to be repaid out of the Rates towards New Streets, Widenings and Improvements undertaken since 1856, by the Metropolitan Board of Works and the London County Council (up to Session 1904), in the several Cities and Boroughs in the Administrative[1] County of London.

Cities and Metropolitan Boroughs.	Present rateable value (April 1904).	Mean rateable value for the period 1856–1904.	Total net sum spent since 1856.	Average net sum per annum spent since 1856.	Equivalent of average net sum per annum spent since 1856, expressed in rate per £ on valuation in column 3.	Equivalent of average net sum per annum spent since 1858, expressed in rate per £ on valuation in column 2.
1.	2.	3.	4.	5.	6.	7.
	£	£	£	£	d.	d.
City of London	5,019,371	3,127,794	1,682,321	34,333	2·63	1·64
Battersea	1,021,115	550,107	287,146	5,860	2·56	1·38
Bermondsey	925,000	608,703	971,477	19,826	7·82	5·14
Bethnal Green	527,941	316,181	223,391	4,559	3·46	2·07
Camberwell	1,293,905	751,953	580,048	11,838	3·78	2·20
Chelsea	822,293	519,493	—	—	—	—
Deptford	608,965	354,067	162,130	3,309	2·24	1·30
Finsbury	980,428	691,117	1,124,070	22,940	7·97	5·62
Fulham	823,541	435,516	105,087	2,145	1·18	0·63
Greenwich	593,002	385,551	110,837	2,262	1·41	0·92
Hackney	1,185,901	708,896	610,294	12,455	4·22	2·52
Hammersmith	717,664	392,582	103,965	2,122	1·30	0·71
Hampstead	997,438	537,231	83,462	1,703	0·76	0·41
Holborn	951,281	703,101	2,051,081	41,859	14·29	10·56
Islington	1,930,025	1,183,513	219,559	4,481	0·91	0·56
Royal Borough of Kensington	2,271,557	1,256,920	210,227	4,290	0·82	0·45
Lambeth	1,901,016	1,195,635	176,341	3,599	0·72	0·45
Lewisham	952,852	542,576	215,450	4,397	1·94	1·11
Paddington	1,473,043	951,522	150,792	3,077	0·78	0·50
Poplar	815,529	516,893	85,597	1,747	0·81	0·51
St. Marylebone	1,738,347	1,368,859	112,888	2,304	0·40	0·32
St. Pancras	1,800,201	1,253,293	378,365	7,722	1·48	1·03
Shoreditch	782,003	516,775	514,324	10,496	4·88	3·22
Southwark	1,258,824	867,242	480,608	9,808	2·71	1·87
Stepney	1,433,439	1,077,493	809,213	16,515	3·68	2·77
Stoke Newington	344,155	185,483	—	—	—	—
Wandsworth	1,713,723	966,821	354,580	7,236	1·80	1·01
City of Westminster	5,516,725	3,793,341	2,733,329	55,782	3·53	2·43
Woolwich	689,212	412,771	34,250	699	0·41	0·24
Totals and Averages	41,088,496	26,171,429	14,570,832	297,364	2·73	1·74

NOTE.—In some cases contributions were made by the local authorities to the cost of the above works.

[1] As the Administrative County of London was constituted in 1889, and the Metropolitan Boroughs in pursuance of the London Government Act, 1899, this table must be construed, as being in each case, so far as practicable, referable to the areas from time to time constituting the Administrative County and those now forming the individual Metropolitan Boroughs.

The next table gives the corresponding expenditures by the constituent local authorities within the Administrative County of London, and, in this case, we are able to give the sums expended during the last 15 years separately from those expended between 1856 and 1889.

TABLE V.

Estimated Cost of Street Widenings and Improvements undertaken by Local Authorities within the Administrative County of London since 1856.

Cities and Metropolitan Boroughs. (*See* note on previous page.)	Estimated net cost of local improvements.			Average sum spent per annum (48 years).	Equivalent of average sum spent per annum expressed in rate per £ on mean rateable value for the period 1856 to 1904.	Equivalent of average sum spent per annum expressed in rate per £ on rateable value of 1904.
	January 1856 to March 1889.	April 1889 to March 1904.	Total.			
1.	2.	3.	4.	5.	6.	7.
	£	£	£	£	d.	d.
City of London	1,351,388	1,034,270	2,385,658	49,701	3·81	2·38
Battersea	25,025	88,695	113,720	2,369	1·03	·56
Bermondsey	45,629	5,615	51,244	1,068	·42	·28
Bethnal Green	8,848	430	9,278	193	·15	·09
Camberwell	13,300	1,000	14,300	298	·10	·06
Chelsea	24,546	15,577	40,123	836	·39	·24
Deptford	4,359	800	5,159	107	·07	·04
Finsbury	130,787	3,100	133,887	2,789	·97	·68
Fulham	17,259	28,081	45,340	945	·52	·28
Greenwich	6,071	1,691	7,762	162	·10	·07
Hackney	21,034	2,745	23,779	495	·17	·10
Hammersmith	16,478	64,844	81,322	1,694	1·04	·57
Hampstead	85,528	6,250	91,778	1,912	·85	·46
Holborn	28,300	7,630	35,930	749	·26	·19
Islington	16,909	14,428	31,337	653	·13	·08
Royal Borough of Kensington	112,230	24,505	136,735	2,849	·54	·30
Lambeth	16,600	453	17,053	355	·07	·04
Lewisham	21,605	5,905	27,510	573	·25	·14
Paddington	20,296	23,526	43,822	913	·23	·15
Poplar	46,573	14,016	60,589	1,262	·59	·37
St. Marylebone	101,759	—	101,759	2,120	·37	·29
St. Pancras	58,742	22,700	81,442	1,697	·32	·23
Shoreditch	12,092	3,055	15,147	316	·15	·10
Southwark	12,921	1,780	14,701	306	·08	·06
Stepney	181,651	41,771	223,422	4,655	1·04	·78
Stoke Newington	3,200	11,595	14,795	308	·40	·21
Wandsworth	31,530	146,470	178,000	3,708	·92	·52
City of Westminster	66,056	225,213	291,269	6,068	·38	·26
Woolwich	14,076	17,804	31,880	664	·39	·23
Totals and Averages	2,494,792	1,813,949	4,308,741	89,765	·82	·52

NOTE.—In some cases contributions were made by the London County Council to the cost of the above works.

For the figures in Tables IV. and V. we are also indebted to the London County Council.

From these tables it appears that the total sum expended out of the County Rate and local rates, towards new streets, widenings and improvements, within the Administrative County of London, during the past 48 years, 1856 to 1904, amounted to £18,879,573, or an average of £393,325 per annum, equivalent to an average rate over that period of 3·55*d.* in the £ on the mean rateable value, or 2·26*d.* in the £ on the present rateable value. It is interesting to compare these figures with those already given for Paris on page 4.

London can be made equal to other cities.

The above figures of expenditure on street improvements in the Administrative County of London appear to us to be very small when considered in relation to the size, importance, and wealth of London.

If our suggestions be adopted, it is believed that London will have laid the foundations for a system of locomotion both suburban and inter-urban which, taken in connection with the facilities in that behalf already existing, will be inferior to those of no other city in the world. Such a position London is entitled to hold. If, on the other hand, after consideration, it should be held that the recommendations are too expensive, then, in proportion as the suggestions are reduced in scope or in size, will the measure of relief to London and its inhabitants be reduced.

Control should be vested in one authority or one board.

The provision of facilities for locomotion of an adequate nature being essentially a matter of concern for the whole body politic, we believe it to be absolutely essential for the proper development of the traffic of London that the regulation or control thereof should be vested in some one authority or some one board, in order that, when, in the future, plans for the provision of any such facilities are considered, such plans may be studied with a view to the needs of the whole community, so that when any local improvement is proposed to be undertaken, it shall be regarded as an integral part of a larger and more comprehensive scheme. In this way, bit by bit, street by street, these local improvements may be gradually welded one to the other. The reverse of this policy has unfortunately been heretofore the custom, with results that are patent to everyone, and to which we have already referred.

Judicious centralisation.

With regard to the administration of traffic, this same principle can with advantage be carried one step further, as has become the rule in some other cities, by, not only permitting, but encouraging, an arrangement by which local systems of tramways and railways may be brought under single control and management, either of the municipality, if that be deemed best, or, as is the custom in America, and generally on the Continent, of a private company, under proper regulation and public supervision. By such judicious centralisation we believe that the ideal arrangement will be reached, and the greatest measure of travelling facilities afforded to the public.

STATISTICS OF POPULATION AND TRAFFIC.

Amount of goods and passenger traffic to be accommodated.

HAVING now briefly referred to the extent of "Greater London," and to the manner in which it is divided for the purposes of local government, it is necessary, before proceeding to deal with the questions submitted to us, to consider, with as great accuracy as may be practicable, such data as are available bearing on the subject of the daily amount of goods and passenger traffic to be accommodated. We find that on the amount, distribution, density, and character of the night population exhaustive information is to be obtained from the Census Returns; but particulars with reference to the distribution and character of industries, and the movement of goods and passengers are either wanting or insufficient, and we have therefore instituted inquiries and observations on the latter points.

Day census required.

It is a matter of regret that no arrangements for taking a day census exist for "Greater London." The necessity for such a census, taken, if possible, the day following the decennial night census and in connection therewith, has been forcibly impressed on us in carrying out these investigations. The relative distribution of the day and night population, and the localities in which various industries are carried on, have an important bearing upon the demand for facilities for the carriage of both goods and passengers.

Movement of goods.

As regards the movement of goods, the broad features of the case in this section of our report should be considered in conjunction with the detailed statistics of the traffic in leading thoroughfares (*see* Appendix, Tables Nos. 9 to 57, Volume VIII.), which we refer to when dealing hereafter with street improvements. *Tables Nos.*

Traffic in certain streets.

To convey, however, at once an intelligible idea of the volume of traffic in some of the main thoroughfares, we now give particulars of the traffic in the following streets :—

TABLE VI.

Traffic in selected Streets.

Street.	Goods Vehicles.				Passenger Vehicles.				Cycles and Barrows.				Total Vehicles of all Classes.		
	Day (8 a.m. till 8 p.m.)		Busiest Hour.		Day (8 a.m. till 8 p.m.)		Busiest Hour.		Day (8 a.m. till 8 p.m.)		Busiest Hour.		Day (8 a.m. till 8 p.m.)	Busiest Hour.	
	Number.	Per cent. of Total.	Number.	Per cent. of Total.	Number.	Per cent. of Total.	Number.	Per cent. of Total.	Number.	Per cent. of Total.	Number.	Per cent. of Total.	Number.	Number.	Per cent. of Total during Day.
Bayswater Road (West of Edgware Road)	2,832	24·0	181	14·7	7,274	61·5	817	66·3	1,710	14·5	234	19·0	11,816	1,232	10·4
Oxford Street (East of Regent Street)	3,778	27·0	349	26·0	8,192	58·5	913	67·7	2,043	14·5	85	6·3	14,013	1,347	9·6
Cheapside (East of St. Paul's Churchyard)	4,436	35·3	505	38·2	6,108	48·6	600	45·4	2,019	16·1	217	16·4	12,563	1,322	10·5
Aldgate High Street (East of Minories)	6,943	64·5	719	70·3	1,796	16·7	165	16·1	2,019	18·8	139	13·6	10,758	1,023	9·5
Piccadilly (East of Hamilton Place)	3,118	22·3	249	18·3	9,616	68·6	974	71·6	1,278	9·1	136	10·1	14,012	1,359	9·7
Fleet Street (West of Ludgate Circus)	2,916	32·7	282	32·8	4,933	55·2	487	56·6	1,083	12·1	91	10·6	8,932	860	9·6
Victoria Embankment (West of Blackfriars Bridge)	2,875	31·7	278	27·6	5,266	58·1	675	67·0	922	10·2	54	5·4	9,063	1,007	11·1
Queen Victoria Street (East of Cannon Street)	3,382	27·4	379	28·4	7,780	63·2	870	65·3	1,157	9·4	83	6·3	12,319	1,332	10·8

Varying percentage of traffic.

It will be observed that, in Table VI., the traffic is divided into vehicles engaged in the carriage of goods and passengers respectively, apart from cycles and barrows. It is important to note the varying percentage which the several classes of traffic bear, one to the other, in the different streets, and the proportion which the traffic during the "busiest hour" bears to the whole. These particulars materially affect the subsequent consideration of the causes of congestion of particular streets and intersections of streets, and have an important bearing on possible means of relieving the same. (*See* pages 42 to 62).

"Greater London" divided into zones and sections.

For the purposes of our inquiry, it was necessary to divide up the area of "Greater London" into zones, according to the density and character of the population, and, again, radially into sections. This had already been done by Mr. Edgar Harper, the Statistical Officer to the London County Council, in connection with his evidence before the Royal Commission, and, as the divisions were suitable to our purpose, and enabled us to utilise his statistics, we have adopted them, but we show a modification in the case of the tables of goods traffic, which we later describe.

Three zones.

London is accordingly divided into three zones by the boundaries of (1) the "Central Area," (2) the County of London, and (3) "Greater London." These boundaries are shown upon Plan No. 6, facing page 14, and, with the exception of the first, there is no need to describe them in detail.

Plan No.

"Central Area."

The "Central Area" includes the City of London, the City of Westminster, and the Metropolitan Boroughs of St. Marylebone, Holborn, Finsbury, Shoreditch, Bethnal Green, Stepney, Bermondsey, and Southwark, together with parts of St. Pancras and Lambeth.

Radially, London has been divided into the following five sections, as also shown on Plan No. 6 :—

Five sections.

"Western."—From the river northwards to a line following approximately the Edgware Road to the boundary of Hertfordshire. This section includes the City of Westminster and the Metropolitan Boroughs of Paddington, Kensington, Hammersmith, Fulham, Chelsea, and the following civil parishes in the County of Middlesex:—Acton, New Brentford, Old Brentford, Chiswick, Ealing, Feltham, Greenford, Perivale, Twyford Abbey, Hampton, Hampton Wick, Hanwell, Harrow-on-the-Hill, Hayes, Heston, Isleworth, Kingsbury, Ruislip, Norwood, Staines, Sunbury, Teddington, Twickenham, Hillingdon West, Uxbridge, Wealdstone, Wembley, Willesden, Great Stanmore, Harrow Weald, Little Stanmore, Pinner, Ashford, Cranford, East Bedfont, Hanworth, Harlington, Harmondsworth, Laleham, Littleton, Shepperton, Stanwell, Cowley, Harefield, Hillingdon East, Ickenham, Northolt, West Drayton, Yiewsley.

"Northern."—From the Edgware Road to the Kingsland Road (approximately) in the Administrative County of London and in "Extra-London" the river Lea. This section includes the City of London and the Metropolitan Boroughs of Hampstead, St. Pancras, Islington, Stoke Newington, Holborn, Finsbury, Shoreditch, and St. Marylebone, and the following civil parishes in the County of Middlesex : Edgware, Hendon, Finchley, Hornsey, Friern Barnet, Wood Green, Tottenham, Edmonton, Southgate, Enfield and South Mimms, and that portion of the County of Hertfordshire within the "Greater London" boundary *i.e.*, the civil parishes of Cheshunt, Northaw, Ridge, Shenley, South Mimms Urban, Arkley, Hadley, Totteridge, Chipping Barnet, Monken Hadley, Barnet Vale, East Barnet, Elstree, Aldenham, Bushey Rural and Bushey Urban.

"Eastern."—From the Kingsland Road and the river Lea southwards to the river Thames. This section includes the Metropolitan Boroughs of Hackney, Poplar, Bethnal Green, Stepney, and that portion of Woolwich north of the Thames, and that portion of the County of Essex within the "Greater London" boundary, *i.e.*, the civil parishes of Barking, Buckhurst Hill, Chingford, East Ham, Ilford, Cann Hall, Low Leyton, Loughton, Waltham Abbey, Walthamstow, Wanstead, West Ham, Woodford St. Mary, Chigwell, and Dagenham.

"South-Eastern."—From the river Thames to the western boundary of the Metropolitan Boroughs of Bermondsey and Camberwell, and of the

parishes of Croydon and Coulsdon. This section includes the Metropolitan Boroughs of Camberwell, Deptford, Lewisham, Greenwich, Woolwich (excluding that portion north of the Thames), and Bermondsey, and that portion of the County of Kent within the "Greater London" boundary, *i.e.*, the civil parishes of Beckenham, Bexley, Bromley, Chislehurst, Erith, Foots Cray, Penge, Downe, Farnborough, Hayes, Keston, Mottingham, North Cray, Orpington, St. Mary Cray, St. Pauls Cray, West Wickham, and Crayford, together with the following civil parishes in the County of Surrey :—Croydon, Coulsdon, Sanderstead, Warlingham, Farley, and Addington.

"South-Western."—From the western boundary of Bermondsey, Camberwell, Croydon, and Coulsdon westward to the Thames. This section includes the Metropolitan Boroughs of Wandsworth, Battersea, Lambeth and Southwark, and the remainder of the County of Surrey within the "Greater London" boundary, *i.e.*, the civil parishes of Barnes, Mortlake, Carshalton, East Molesey, West Molesey, Epsom, Long Ditton, Thames Ditton, Ham, Kingston-upon-Thames, Kew, North Sheen, Petersham, Richmond, Hook, Surbiton, Tolworth, Sutton, Coombe, Malden, New Malden, Wimbledon, Banstead, Cheam, Chessington, Cuddington, Ewell, Beddington, Merton, Mitcham, Morden, Wallington, and Woodmansterne.

Night population in zones and sections—Census 1901.

Table VII. below shows the resident population in each zone and section according to the Census of 1901 (taken at night), and the percentage of increase or decrease for the last decade; also the number of persons over 10 years of age engaged in business, together with an estimate of the day population in the "Central Area" at the present time.

TABLE VII.

Population of London.

Zone and Section.	Night Population. Total on Basis of 1901 Census.	Increase or Decrease per cent. in last Decade.	Persons Employed in Business over 10 Years of Age.	Estimated Day Population.
"Central Area" :—				
City	26,923	— 28·6 %	17,135	427,000
Remainder of "Central Area" (less St. Pancras and Lambeth)	1,361,037	— 2·8 %	675,611	2,000,000
Totals, "Central Area" (less St. Pancras and Lambeth)	1,387,960	— 3·4 %	692,746	2,427,000
Remainder of the Administrative County of London (less North Woolwich, but including St. Pancras and Lambeth) :—				
"Western Section"	643,974	+ 13·4 %	307,739	—
"Northern Section" (including St. Pancras)	703,497	+ 5·0 %	335,833	—
"Eastern Section"	388,094	+ 5·9 %	173,495	—
"South-Eastern Section"	707,094	+ 17·9 %	301,551	—
"South-Western Section" (including Lambeth)	702,836	+ 20·2 %	306,616	—
Totals	3,145,495	+ 12·7 %	1,425,234	—
Totals for the Administrative County of London	4,533,455	+ 7·3 %	2,117,980	—
Remainder of "Greater London" (including North Woolwich) :—				
"Western Section"	420,041	+ 45·0 %	168,745	—
"Northern Section"	417,009	+ 43·9 %	[1]172,710	—
"Eastern Section"	675,300	+ 62·4 %	[1]252,868	—
"South-Eastern Section"	295,819	+ 30·3 %	[1]109,285	—
"South-Western Section"	239,778	+ 29·1 %	[1]86,278	—
Totals	2,047,947	+ 45·5 %	[1]789,886	—
Totals for "Greater London"	6,581,402	+ 16·8 %	2,907,866	—

[1] These figures are incomplete, as in the Census Returns the occupied classes are only given for urban districts exceeding 5,000 inhabitants.

Increase and decrease of population in various sections.

It will be seen that the population within the "Central Area" is decreasing, while that of the rest of the Administrative County of London is increasing, but at a less rate than that of the outer fringe. In the Administrative County of London, outside the "Central Area," the increase is greatest on the south of the Thames, and, in the area between the County of London and the boundary of "Greater London," the districts north of the river show the highest rates of increase, that of the "Eastern Section" being the largest of all.

Movement of population into "Central Area" each day.

The working population of "Greater London" over 10 years of age would probably be close on 3 millions, while the difference between the resident population of the "Central Area" and the estimated day population indicates that over 1,000,000 persons living in the outlying districts find regular employment within the "Central Area."

ctories.

Table VIII. following shows approximately the principal factories and works in the Administrative County of London, employing over 100 hands, and the hands employed therein in each zone and section within the Administrative County of London; also the proportion which the number of hands employed in the factories bears to the total population engaged in business:—

TABLE VIII.

FACTORIES IN THE ADMINISTRATIVE COUNTY OF LONDON.

Zone or Section.	Number of Factories Employing over 100 Hands.	Approximate Number of Hands Employed therein.	Relation of Hands Employed to Population.
			Per cent.
"Central Area":			
City - - - - - - - - - - - - - - - -	91	24,450	142·8
Remainder of "Central Area" (less St. Pancras and Lambeth)	352	89,000	13·2
Totals "Central Area" (less St. Pancras and Lambeth)	443	113,450	16·3
Remainder of County of London:			
"Western Section" - - - - - - - - - - - -	21	5,350	1·7
"Northern Section" (including St. Pancras) - - - - -	56	12,600	3·8
"Eastern Section" - - - - - - - - - - - -	63	22,450	12·9
"South-Eastern Section" - - - - - - - - - -	42	14,000	4·6
"South-Western Section" (including Lambeth) - - - -	14	5,850	1·9
Totals - - - - - - - - - - - - - -	196	60,250	4·2
Total for the Administrative County of London - -	639	173,700	8·2

The great bulk of the factories are within the "Central Area," and in the neighbouring districts of Poplar, the western part of West Ham, the northern part of Camberwell, and in the western and south-western districts along the banks of the Thames. The concentration is greatest in the western part of the City, and in those parts of Holborn, Finsbury, and Stepney which border upon the City; and, to the south of the Thames, in the northern parts of Lambeth and Southwark, and in the western portion of Bermondsey. In other words, a large percentage of the factories within the "Central Area" are situated in an annular space between radii of half a mile and one and a half miles from the Bank as a centre. The last column of Table VIII. shows that the percentage of hands employed in factories to the night or resident working population, is as much as 142 per cent. in the City, 13 per cent. in the remainder of the "Central Area," and 16·3 per cent. for the whole of the "Central Area." For the remainder of "Greater London," this percentage works out at 4·2, varying for the different sections from 1·7, in the case of the "Western Section," up to 12·9 in the "Eastern Section." For the whole of the Administrative County of London, the percentage amounts to 8·2 per cent.

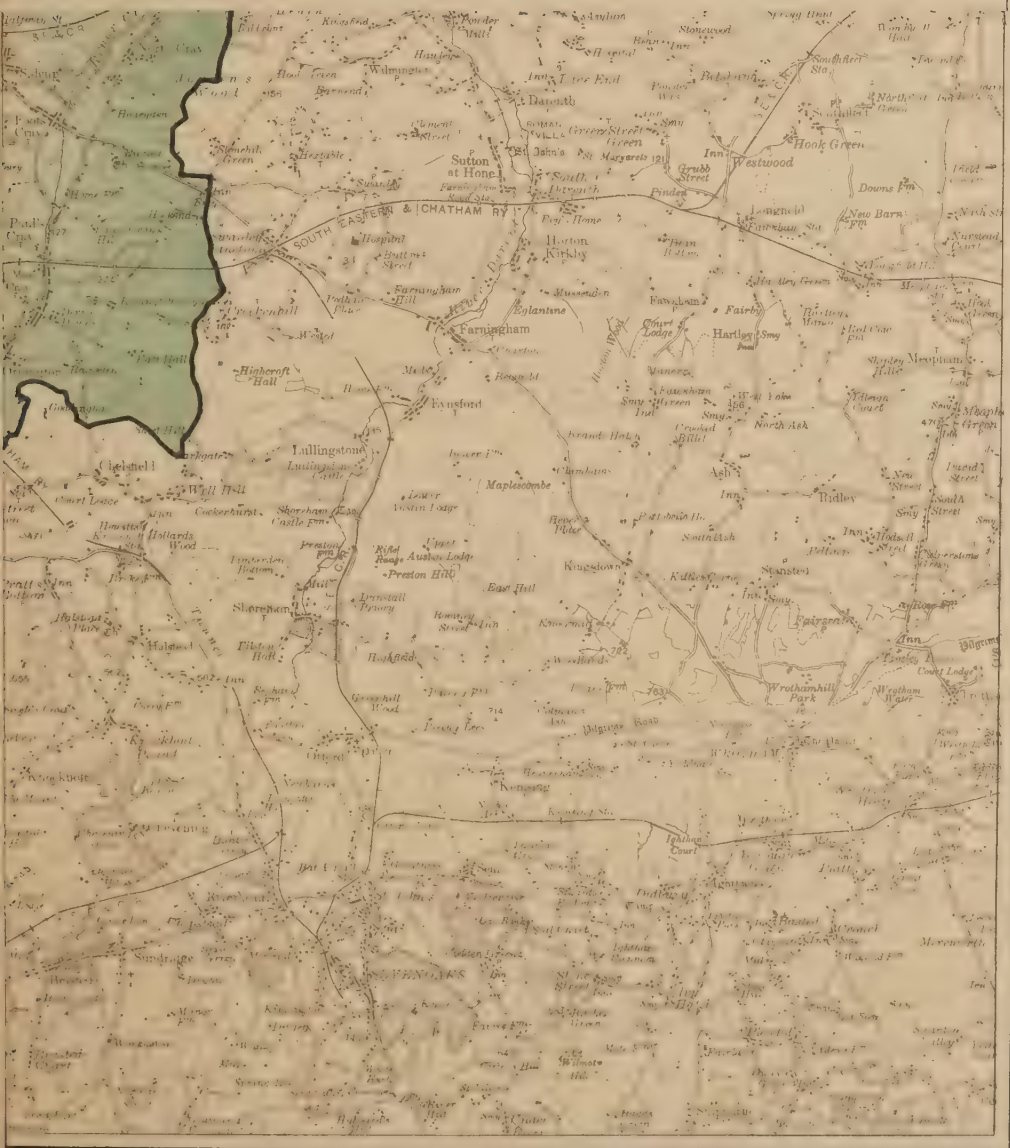
Warehouses.

Table IX. below gives the number and situation of warehouses, manufactories, shops, etc., in the City of London:—

PLAN

SHOWING

GREATER LONDON



Prepared and Printed at the Ordnance Survey Office Southampton, 1905.

TABLE IX.

WAREHOUSES, MANUFACTORIES, SHOPS, ETC., IN THE CITY OF LONDON, IN THREE CLASSES OF RATEABLE VALUE.

WARDS.	£100 AND UNDER.						OVER £100 TO £500.						OVER £500.					
	Warehouses.	Manufactories.	Shops.	Railway Stations and Receiving Offices.	Gas and Water Mains, etc.	Offices, Dwelling-houses and other Buildings.	Warehouses.	Manufactories.	Shops.	Railway Stations and Receiving Offices.	Gas and Water Mains, etc.	Offices, Dwelling-houses, and other Buildings.	Warehouses.	Manufactories.	Shops.	Railway Stations and Receiving Offices.	Gas and Water Mains, etc.	Offices, Dwelling-houses, and other Buildings.
Aldersgate Within	8	—	—	1	20	—	46	—	6	—	7	7	11	—	1	—	1	5
Aldersgate Without	95	4	25	—	5	109	141	13	65	2	1	28	16	1	12	2	2	5
Aldgate	72	6	35	2	9	30	212	5	84	2	11	30	36	1	19	3	3	44
Bassishaw	1	—	—	—	3	—	17	—	11	—	5	1	13	—	3	—	—	12
Billingsgate	13	—	264	2	29	2	55	2	37	3	11	3	32	2	7	1	2	—
Bishopsgate Within	3	1	27	—	15	40	5	2	76	—	14	61	6	—	26	—	3	60
[2]Bishopsgate Without	43	3	88	—	4	21	34	10	188	3	4	39	9	—	18	5	2	21
Bread Street	7	—	—	1	16	—	78	—	8	4	7	4	51	2	8	1	—	1
Bridge	2	2	11	—	6	28	14	3	54	1	2	24	6	3	12	1	2	17
Broad Street	—	—	5	—	29	20	3	—	33	—	22	74	1	3	12	—	7	183
Candlewick	—	—	9	—	23	11	3	—	41	2	9	41	2	—	14	—	—	28
Castle Baynard	24	3	8	2	14	10	113	9	37	3	13	15	55	1	14	4	4	9
Cheap	10	—	9	1	30	13	31	4	76	1	12	34	9	1	54	1	2	28
Coleman Street	2	1	33	—	10	5	12	—	118	3	5	93	4	1	20	3	3	97
Cordwainer	15	—	15	2	30	18	51	3	71	5	11	28	13	1	17	3	—	18
Cornhill	—	—	1	—	2	3	—	—	20	1	6	6	1	—	14	1	2	47
Cripplegate Within	41	—	6	2	28	10	208	9	24	2	14	6	90	1	5	3	2	3
Cripplegate Without	237	40	53	3	2	30	322	63	83	8	3	14	36	8	8	4	3	6
Dowgate	11	—	8	—	19	8	48	16	10	1	12	4	17	4	—	1	—	4
Farringdon Within	36	6	36	3	39	26	180	5	136	5	22	25	54	4	51	4	6	18
Farringdon Without:—																		
St. Andrew	75	19	40	—	16	154	120	30	36	—	2	57	8	9	7	2	2	6
St. Bride	23	17	79	—	19	165	59	33	112	3	7	114	20	15	31	1	5	42
St. Dunstan	10	22	31	—	19	815	8	33	64	1	7	102	2	22	11	1	5	24
St. Sepulchre	67	9	209	6	10	255	119	22	263	1	6	79	23	2	14	7	4	10
Langbourn	1	—	10	—	28	2	18	1	68	2	14	22	29	—	32	—	—	60
Lime Street	4	—	5	—	5	4	6	1	40	—	3	26	7	—	6	—	2	34
Portsoken	90	3	220	4	3	319	91	5	76	2	3	8	11	3	2	6	2	9
Queenhithe	13	5	10	—	29	12	75	13	26	3	14	13	26	5	3	1	—	3
Tower	23	—	18	2	14	7	94	1	26	2	8	16	87	1	4	2	5	6
Vintry	6	2	2	2	20	4	46	14	13	3	8	20	27	2	2	1	—	7
Walbrook	1	—	7	3	19	15	7	—	37	2	10	17	10	—	17	2	—	35
TOTALS	983	143	1,264	36	515	2,136	2,216	297	1,939	65	273	1,011	712	92	444	60	69	842

NOTE.—The shops in the City Market are shown separately, and the fixed "stands" in Billingsgate Market counted as shops.

[1] The whole of the Buildings occupied for the purposes of the General Post Office are entered in the "Buildings other than these" column, counting as 4 over £500.

[2] Assessments similar to that in respect of the Great Eastern Railway Station, which is assessed in one amount at £58,000 rateable value, have been analysed and the shops, etc., counted and shown separately.

SUMMARY: Warehouses, 3,911; Manufactories, 532; Shops, 3,647; Railway Stations and Receiving Offices, 161; Gas, Water Mains, etc., 857; Offices, Dwelling-houses, and other Buildings, 3,989; Total, 13,097.

Situation of warehouses.

As shown by Table IX., the area within the City is very largely occupied by warehouses. In the case of factories, the number quite close to the Bank is small, but increases on the outer fringe of the City and the adjoining neighbourhood. Thus it may fairly be said that the district immediately around the Bank is devoted to warehouses and offices, while around this centre are situated both factories and warehouses. Both these classes of property naturally give rise to a large goods traffic, and their concentration about the very centre of London is no doubt one of the chief causes of the congestion, and difference in the class of vehicular traffic in and near the City as compared with that in the "West End." (See page 56).

Goods traffic.

Detailed observations undertaken as to the traffic at particular points, which are given later in this report (see pages 48–62), show the large number of goods vehicles which pass street junctions, such as those at the Bank and the General Post Office.

"Central Goods Area."

In order to include a number of important points, tables relating to goods are based upon an area which we have called the "Central Goods Area." The "Central Goods Area" and the boundaries of the various divisions referred to in the tables relating to goods traffic are shown upon Plan No. 7 in the Appendix (Volume VIII.), and the routes followed by railway goods vehicles are also indicated. *Plan No. 7.*

The following statement in Table X. of the points of destination and origin of the vehicles entering and leaving a number of the chief goods stations belonging to the railway companies indicates the extent of the traffic carried on within the limits of the "Central Goods Area," the greater part of which is to and from the districts immediately about the centre :—

TABLE X.

NUMBER OF VEHICLES ARRIVING AT AND DEPARTING FROM THE CHIEF GOODS STATIONS IN OR NEAR THE "CENTRAL GOODS AREA" OF LONDON BETWEEN 7 A.M. AND 8 P.M. ON THE DATES MENTIONED.

Division and Station.	Railway Company.	Date of Enumeration.	Points of Destination and Origin.					
			"Central Division."	"Western Division."	"Northern Division."	"Eastern Division."	"Southern Division."	Total.
"Central Division"—		1904.						
Smithfields	G. W.	—	455	60	—	144	188	847
Whitecross Street	Mid.	Aug. 5	466	72	109	78	71	796
Broad Street	L. & N.W.	Feb. 19	822	90	87	296	252	1,547
Haydon Square	L. & N.W.	,,	98	13	—	141	129	381
Goodman's Yard	G. E.	July 29	165	40	10	169	97	481
Total			2,006	275	206	828	737	4,052
"Western Division"—								
Paddington	G. W.	—	417	657	—	156	160	1,390
Marylebone	G. C.	Aug. 10	221	176	68	117	142	724
Total			638	833	68	273	302	2,114
"Northern Division"—								
Camden	L. & N.W.	Feb. 19	127	327	188	148	108	898
Maiden Lane	,,	,,	62	31	375	18	10	496
St. Pancras	Mid.	Aug. 5	214	1,022	—	591	120	1,947
King's Cross	G. N.	Oct. 20	751	985	1,484	518	469	4,207
Somers Town	Mid.	Aug. 5	132	1,001	—	423	131	1,687
Farringdon Street	G. N.	Oct. 20	415	64	53	172	248	952
Total			1,701	3,430	2,100	1,870	1,086	10,187

TABLE X.—*continued.*

NUMBER OF VEHICLES ARRIVING AT AND DEPARTING FROM THE CHIEF GOODS STATIONS IN OR NEAR THE "CENTRAL GOODS AREA" OF LONDON BETWEEN 7 A.M. AND 8 P.M. ON THE DATES MENTIONED—*continued.*

Divison and Station.	Railway Company.	Date of Enumeration.	Points of Destination and Origin.					
			"Central Division."	"Western Division."	"Northern Division."	"Eastern Division."	"Southern Division."	Total.
"Eastern Division"—								
Bishopsgate	G. E.	July 29	1,094	325	270	1,199	639	3,527
Spitalfields	,,	,,	157	99	142	670	175	1,243
Devonshire Street	,,	,,	35	44	231	988	104	1,402
Commercial Road	L. T. & S.	Aug. 12	238	56	18	245	147	704
Royal Mint Street	Mid.	Aug. 5	46	11	—	111	55	223
,, ,, ,,	G. N.	Oct. 20	329	—	6	282	38	655
Total			1,899	535	667	3,495	1,158	7,754
"Southern Division"—								
Willow Walk	L. B. & S. C.	—	828	41	41	118	159	1,187
Bricklayers' Arms	S. E. & C.	Oct. 11	426	225	227	263	1,655	2,796
Blackfriars	,,	,,	395	204	112	366	1,145	2,222
Southwark Depôt	,,	Dec. 15	119	14	2	—	55	190
Nine Elms	L. & S. W.	June 3	1,103	605	—	440	490	2,638
Stewart's Lane	S. E. & C.	Oct. 11	4	56	6	4	369	439
Total			2,875	1,145	388	1,191	3,873	9,472
Grand Total			9,119	6,218	3,429	7,657	7,156	33,579

NOTE.—Where no date is given it may be assumed that the particulars were taken on an ordinary week-day.

Further details as to goods traffic.

Table X. contains only a summary of the particulars which we have collected as to the carriage of heavy goods by the railway companies in London, but, in Tables Nos. 1, 2, and 3 in the Appendix (Volume VIII.), additional details will be found, and also particulars as to the traffic in light goods and parcels conducted by some of the railway companies and by certain of the large public carriers.

Tables Nos. 1, 2, and 3.

Light goods and parcel traffic.

The details of the light goods and parcel traffic further tend to establish the inference to be drawn from Table X. as to the concentration of traffic in the City and its immediate neighbourhood. For instance, it appears that, out of a total of 14,067 calls recorded in the tables in the Appendix (Volume VIII.) as taking place daily at minor goods and receiving offices within the "Central Goods Area," 4,840 were within the City and neighbourhood. Again, it appears from the tables relating to goods traffic that 33 per cent. of the traffic to and from the stations mentioned therein is with the City, the area of which may be taken as one square mile, as against about 21½ square miles which is the area of the remaining portion of the "Central Goods Area." In other words, the traffic in the City and its immediate neighbourhood is approximately nine times as great per square mile of area as the average per square mile of the remainder of the "Central Goods Area."

Coal traffic.

Besides the miscellaneous goods traffic mentioned above, there is the cartage of coal for domestic and other uses in "Greater London," which has attained very large proportions. While statistics of the quantity of coal entering London are available, and show the amount to be about 15,000,000 tons per annum, we have only been able to make an approximate estimate of the total amount carted through the streets. A Select Committee of the House of Commons, reporting in 1873, gave the coal consumed in London for domestic, railway, and steamboat purposes in 1869 at 14 cwt. per head of the population, while the total consumption for other purposes amounted to a further 13 cwt. per head, and stated that the coal passing

through London came to about 8 cwt. per head, or a total entering London of 1 ton 15 cwt. per head. Assuming the present population to be 6,850,000, the total quantity of coal entering "Greater London" now amounts to about 2 tons 4 cwt. per head, or 9 cwt. in excess of the quantity in 1869. Apportioning this increase we obtain at the present time a consumption for domestic, railway, and steamboat purposes of 17½ cwt., for other purposes 16½ cwt., and in transit 10 cwt. per head of the population. These figures are, of course, quite approximate, but it would appear reasonable to assume that the consumption by small manufactories, unprovided with railway sidings or water access, equals, or at any rate nearly equals, that by railways and steamboats within the metropolitan area, and that, therefore, the quantity of coal carted through the streets at the present time is nearly 1 ton per head per annum of the population. On the basis of this estimate, it appears that some 22,000 journeys are made by coal carts within "Greater London" during an ordinary week-day, the outward and return journey being counted separately.

It should perhaps be mentioned that no doubt a quantity of the coal entering London is carted more than once, but we have been compelled for want of data to arrive at the above figures on such broad lines that this point can hardly be usefully considered.

Congestion of streets in "Central Area."

Again, it is to be borne in mind that in the "Central Area," where the congestion of the streets is by far the greatest, the resident population has decreased, and there is no reason to suppose that the number of factories and workshops has to any great extent increased. Thus it would appear reasonable to adopt now for the "Central Area" much the same figures as those of 1873.

Volume and direction of passenger traffic.

The foregoing statistics serve to give some idea of the goods traffic in general dealt with in the component parts of "Greater London," but we have obtained more detailed information than we possess with regard to goods, as to the present volume and direction of passenger traffic. This may be divided into two classes: (*a*) movement within the "Central Area," and (*b*) movement between the "Central Area" and the remaining districts of "Greater London."

City of London passenger traffic.

Dealing with movement within the "Central Area," it is convenient first to consider the traffic in and out of the City of London, which was dealt with in evidence before the Royal Commission in considerable detail. Mr. A. C. Morton estimated,[1] from an enumeration in 1903, the total number of people entering the City of London every week-day at 1,200,000 persons, of which 400,000 went there daily to work, and the remainder for various reasons; some no doubt going in and out more than once a day. Table XII., taken from Mr. Morton's evidence, gives the various routes followed, and also corresponding figures for 1891 and the percentage of increase between those dates:—

TABLE XII.

CENSUS OF PERSONS ENTERING CITY.

ROUTES FOLLOWED.	1891. 24 Hours.	1903. 24 Hours.	Increase per cent. between 1891–1903.	Percentage of total (1,200,000).
Railways	266,415	271,606	1·94	22·63
Bridges	196,654	200,509	1·96	16·71
Holborn and neighbouring streets	121,752	124,065	1·89	10·34
Fleet Street	114,223	116,279	1·80	9·69
Finsbury Pavement	91,790	93,332	1·67	7·78
Aldgate	89,004	90,289	1·44	7·52
Bishopsgate Street	85,685	86,713	1·19	7·23
Tower Street	77,223	77,994	1·00	6·50
Aldersgate Street	49,502	50,016	1·03	4·17
Farringdon Street	43,494	43,751	0·59	3·65
Golden Lane	28,337	28,465	0·45	2·37
Victoria Embankment	16,930	16,981	0·30	1·41
River	5,085	—	—	—
Totals	1,186,094	1,200,000	1·17	100·00

[1] Mr. A. C. Morton, Q. 1763, Vol. II.

Further evidence on this subject was given by Mr. W. R. Pryke,[1] by Superintendent Francis[2] and by other witnesses. Of the total number of 1,200,000 people entering the City of London, it appears that only about 272,000 were carried by railways, so that the remainder must either have been pedestrians or have been carried in by road vehicles.

"Central Area" passenger traffic by railway.

In excess of the traffic to and from the City of London, there is a very large traffic in and about the rest of the "Central Area" which is mainly served by the "Inner Circle," the Central London, and the City and South London Railways and by horse omnibuses. Statistics given in Tables Nos. 68 and 69 in the Appendix (Volume VIII.) of the traffic to stations, nine in all, on the Metropolitan Railway, and to stations, seven in all, on the Metropolitan District Railway, serve to indicate the traffic on the "Inner Circle" Railway; while Tables Nos. 70 and 71 in the Appendix (Volume VIII.) show the number of passengers using the stations on the Central London, City and South London, Waterloo and City, and Great Northern and City Railways. The figures are not complete, as all the stations have not been counted, but it would appear that approximately 380,000 persons enter and about the same number leave all the stations on the railways of these companies within the "Central Area" during an ordinary week-day.

Tables Nos. 68, 69.

Tables Nos. 70, 71.

"Central Area" passenger traffic by tramway.

The existing tramways do not efficiently serve the "Central Area." On the west, they do not enter it, on the north, they terminate just within the "Central Area," on the east, their termini are situated at the boundary of the City of London and south of the Thames on the approaches to the bridges. No through running of tramways north to south or east to west exists, and although the lines do undoubtedly accommodate short-distance traffic in the outer parts of the "Central Area," they are chiefly of service in carrying people to and from it, the rest of their journey being made on foot or by omnibus. If through running by tramcar were provided, the conditions would be altered, and much of the work now done by omnibuses would fall to the share of the tramcar. Tables Nos. 58 to 65 in the Appendix (Volume VIII.), and Diagrams Nos. 74 to 86 in this Volume and in Volume VIII. show in detail the nature and volume of the traffic on all tramway systems in "Greater London," and a rough estimate of the number of passenger journeys during an ordinary week-day, made wholly or partly by tramways within the "Central Area," gives a total of 520,000, which, of course, includes the traffic to and from the remainder of "Greater London."

Tables Nos. 58 to 65. Diagrams Nos. 74 to 76, 79, 80, 82, 83, 85, 86. *Diagrams Nos. 77, 78, 81, 84.*

"Central Area" passenger traffic by omnibus.

A similar estimate of the number of passenger journeys made by omnibus offers some difficulty, but from figures in our possession as to the total number of such vehicles entering the "Central Area," we think the total may be placed at about 1,150,000.

"Central Area" passenger traffic by railway, tramway, and omnibus.

Thus approximately 2,430,000 passenger journeys are made by the local railways mentioned, by tramways, and by omnibuses, either wholly or partly within the limits of the "Central Area" during a single day.

Demand for means of short-distance traffic exists.

Large as the foregoing figures are, it is certain that the demand for means of short-distance traffic within this area is not satisfied, and that any improvement in the comfort and speed of locomotion would have the immediate effect of increasing the volume of this class of traffic.

Daily passenger traffic from and to the "Central Area."

On the question of locomotion between the "Central Area" and the adjoining districts of "Greater London," the information we have been able to obtain is of a more definite character. By counts at the railway and tramway termini within the "Central Area," and observations on the various omnibus routes at their points of entry, it has been possible to make a fairly accurate estimate of the total number of passengers arriving and departing during the "crush-hours" in the morning and evening and during the whole of an ordinary week-day.

Table No. 4. Diagrams Nos. 1, 2, 3.

The details of this estimate are set out in Table No. 4 in the Appendix (Volume VIII.), and are illustrated by Diagrams Nos. 1, 2 and 3, facing pages 20, 22 and 24 of this Volume, respectively. In the case of railway traffic, the approximate number of trains, local and long-distance, to and from each terminus, during the whole twenty-four hours, is also given.

[1] Mr. W. R. Pryke, Qq. 14635-14731, Vol. II.
[2] Superintendent Francis, Qq. 15091-15187, Vol. II.

While in the case of tramway traffic, the approximate number of cars during the hours of maximum service and during the whole of an ordinary week-day will be found on Diagram No. 77 and also in Table No. 61 in the Appendix (Volume VIII.). The approximate number of omnibuses entering and leaving the "Central Area" during all hours is given in Section E of Table No. 4 in the Appendix (Volume VIII.). *Diagram No. 77. Table No. 61.*

A most important point brought out by Table No. 4 is the duration and amount of traffic which has to be dealt with during the morning and evening "crush-hours." These hours, as regards the inward morning traffic, are the three hours 7 a.m. till 10 a.m., during which period over 41 per cent. of the total inward traffic for the day takes place. In the evening, the three "crush-hours" are from 5 p.m. till 8 p.m., when nearly 43 per cent. of the total outward traffic leaves the "Central Area." Though the total number of passengers inward and outward during these hours is approximately the same, it will be noted that there is a difference in the concentration of traffic during any one hour, for, while in the case of the morning traffics, the proportions for the three hours are 9, 16 and 16 per cent. respectively of the whole traffic inward, during the evening hours the proportions are 13, 17 and 13 per cent. respectively of the whole traffic outward. For the purposes of ready comparison, a summary of Table No. 4 is given as Tables, XIII. and XIV. below, showing the inward and outward traffics during the "crush-hours," and also for the whole day, to *Table No. 4.*

TABLE XIII.

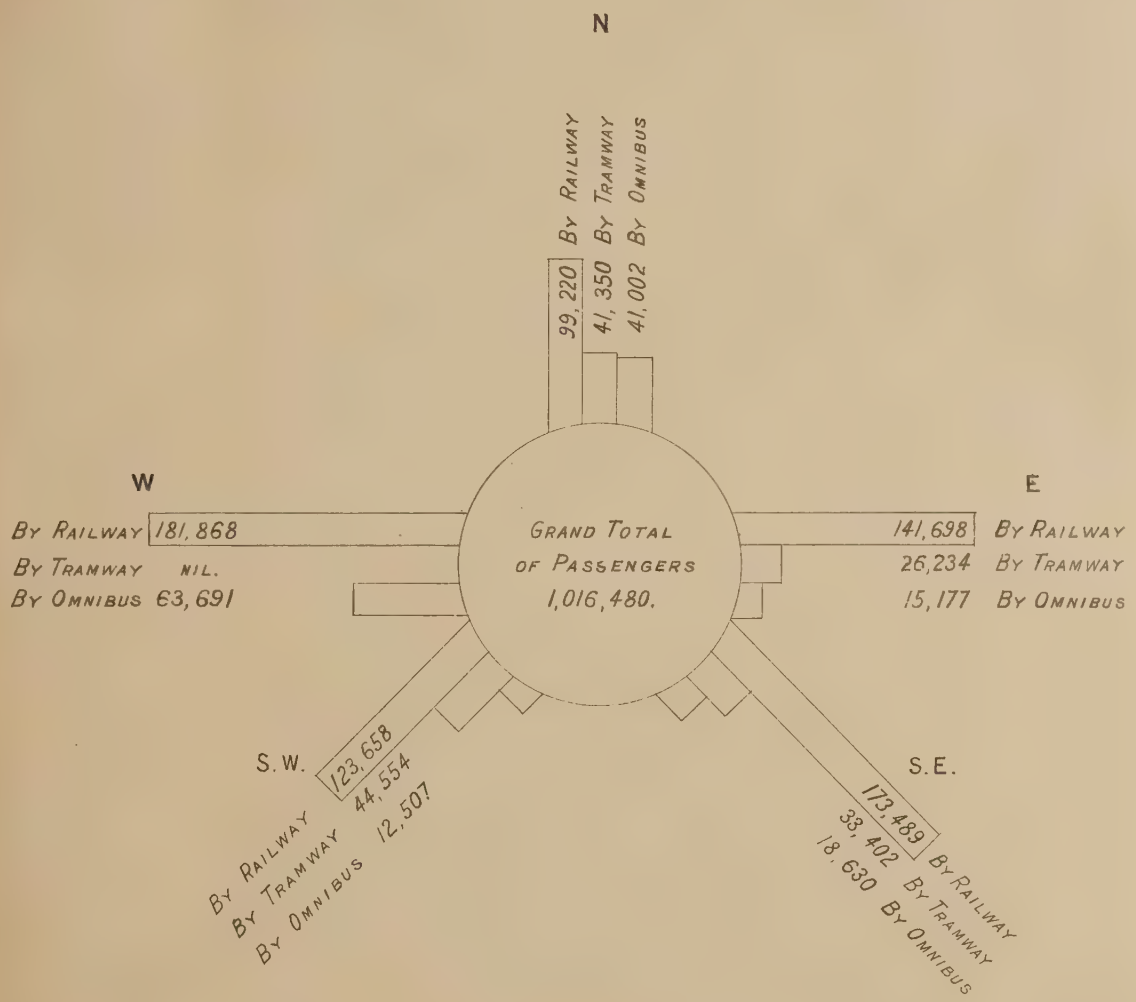
DAILY PASSENGER TRAFFIC TO "CENTRAL AREA" (ONE DIRECTION ONLY).
(*See* DIAGRAMS NOS. 1 AND 3, *post*).

Direction and Means of Conveyance.	7-8 a.m.	8-9 a.m.	9-10 a.m.	Whole Day.	Percentage of Whole Day.
From the West :—					
By Railway	15,451	25,628	24,562	181,868	17·89
By Tramway	—	—	—	—	—
By Omnibus	1,179	6,271	6,751	63,691	6·27
Totals	16,630	31,899	31,313	245,559	24·16
From the North :—					
By Railway	9,403	24,757	24,440	99,220	9·76
By Tramway	2,826	6,517	4,665	41,350	4·07
By Omnibus	1,433	6,594	5,075	41,002	4·03
Totals	13,662	37,868	34,180	181,572	17·86
From the East :—					
By Railway	28,994	27,049	26,040	141,698	13·94
By Tramway	1,599	2,727	1,758	26,234	2·58
By Omnibus	1,033	2,195	1,432	15,177	1·49
Totals	31,626	31,971	29,230	183,109	18·01
From the South-East :—					
By Railway	14,699	24,944	33,086	173,489	17·07
By Tramway	4,236	6,883	3,732	33,402	3·29
By Omnibus	480	2,633	2,306	18,630	1·83
Totals	19,415	34,460	39,124	225,521	22·91
From the South-West :—					
By Railway	8,349	18,748	19,215	123,658	12·17
By Tramway	4,204	7,237	5,867	44,554	4·38
By Omnibus	582	1,784	1,880	12,507	1·23
Totals	13,135	27,769	26,962	180,719	17·78
Grand Totals	94,468	163,967	160,809	1,016,480	100·00
Percentage of Whole Day	9·29	16·13	15·82	100·00	—

ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

DIAGRAM OF DAILY PASSENGER TRAFFIC TO THE CENTRAL AREA OF LONDON (ONE DIRECTION ONLY.)



Analyses of Grand Total.

Direction

Means of Conveyance

Scale 500,000 Passengers to One Square Inch.

5104 5 05.
Weller & Graham, Ltd Litho. London.

TABLE XIV.
DAILY PASSENGER TRAFFIC FROM "CENTRAL AREA" (ONE DIRECTION ONLY).
(*See* DIAGRAMS NOS. 2 AND 3, *post.*)

Direction and Means of Conveyance.	5–6 p.m.	6–7 p.m.	7–8 p.m.	Whole Day.	Percentage of Whole Day.
To the West :—					
By Railway	22,436	30,174	20,901	182,537	17·72
By Tramway	—	—	—	—	—
By Omnibus	6,523	8,297	7,350	65,590	6·37
Totals	28,959	38,471	28,251	248,127	24·09
To the North :—					
By Railway	16,509	22,306	14,846	100,024	9·71
By Tramway	4,210	6,316	7,241	47,143	4·57
By Omnibus	4,174	5,347	5,596	43,109	4·18
Totals	24,893	33,969	27,683	190,276	18·46
To the East :—					
By Railway	23,441	32,980	24,742	142,831	13·87
By Tramway	2,491	3,476	3,360	29,148	2·83
By Omnibus	1,272	1,747	1,711	15,308	1·49
Totals	27,204	38,203	29,813	187,287	18·19
To the South-East :—					
By Railway	25,277	28,441	15,255	163,903	15·91
By Tramway	3,746	5,735	5,992	35,093	3·41
By Omnibus	1,863	2,484	2,379	20,527	1·99
Totals	30,886	36,660	23,626	219,523	21·31
To the South-West :—					
By Railway	17,135	19,037	13,948	124,851	12·12
By Tramway	5,597	6,983	6,129	47,189	4·59
By Omnibus	1,369	1,635	1,580	12,695	1·23
Totals	24,101	27,655	21,657	184,735	17·94
Grand Totals	136,043	174,958	131,030	1,029,948	100·00
Percentage of Whole Day	13·21	16·99	12·72	100·00	—

and from the five sectional divisions of "Greater London" by the three classes of conveyance.

Number of long-distance passengers comparatively small.

Besides the traffic arising within "Greater London," the figures in Tables XIII. and XIV. include railway passengers arriving from and departing for a greater distance. We are not able to give the number of these exactly, but it is so small in proportion to the volume of suburban traffic that it cannot materially affect any conclusions to be drawn from the statistics as affecting the latter subject.

Number carried by railways, tramways, and omnibuses to the "Central Area."

A further point is strikingly brought out by these statistics, namely, the large proportion of the traffic into and from the "Central Area" handled by the railways; between the hours of 9 and 10 a.m. the number of passengers arriving by railway is nearly equal to 90 per cent. of the tramway traffic for the whole day. It will also be noticed that there is a greater concentration of railway traffic during the busy hours than is the case with the other means of conveyance. Of the inward traffic carried by railways, 17⅓ per cent. arrives between 9 and 10 a.m., against only 15¾ per cent. by all means of conveyance; of the outward traffic, 18⅔ per cent. leaves between 6 and 7 p.m., against 17 per cent. by all means of conveyance.

The actual numbers and proportions carried by the different means of

conveyance is shown in Tables XV. and XVI.; and it will be seen that of the inward traffic 70·8 per cent. of the total number of passengers travel by railway, 14·3 per cent. by tramway, and 14·8 per cent. by omnibus, while of the outward traffic 69·3 per cent. travel by railway, 15·4 per cent. by tramway, and 15·3 per cent. by omnibus.

TABLE XV.

SUMMARY OF DAILY PASSENGER TRAFFIC TO "CENTRAL AREA" (ONE DIRECTION ONLY).

(*See* also *Table No. 4.*)

Means of Conveyance.	7–8 a.m.	8–9 a.m.	9–10 a.m.	Whole Day.	Percentage of Whole Day.
By Railway - - -	76,896	121,126	127,343	719,933	70·83
By Tramway - - -	12,865	23,364	16,022	145,540	14·32
By Omnibus - - -	4,707	19,477	17,444	151,007	14·85
Totals - - - -	94,468	163,967	160,809	1,016,480	100·00

TABLE XVI.

SUMMARY OF DAILY PASSENGER TRAFFIC FROM "CENTRAL AREA" (ONE DIRECTION ONLY).

(*See* also *Table No. 4.*)

Means of Conveyance.	5–6 p.m.	6–7 p.m.	7–8 p.m.	Whole Day.	Percentage of Whole Day.
By Railway - - -	104,798	132,938	89,692	714,146	69·34
By Tramway - - -	16,044	22,510	22,722	158,573	15·40
By Omnibus - - -	15,201	19,510	18,616	157,229	15·26
Totals - - - -	136,043	174,958	131,030	1,029,948	100·00

Variation in proportions of traffic inward and outward.

It will be noticed that the proportion of passengers using the three classes of conveyance varies for the inward and outward traffic. From the figures which we have, it is not possible, however, to say whether this is the case during every day in the year.

The greatest variation occurs in the case of tramway traffic, where the excess of outward traffic is over 23,000. If the sum of the railway and omnibus traffics be compared, it will be found that the difference between the inward and outward traffic is only 435. To account for the great variation in the tramway traffic, it may be noted that owing to the fact that nearly all the tramway systems terminate at the boundaries of, or just within the "Central Area," the tramway figures are largely composed of terminal counts, and it is probable that a number of inward passengers alight at the points half-a-mile or so short of the termini, and are, therefore, not included in the terminal counts, while the same passengers find it advisable to walk to the terminus during the evening "crush-hours" in order to obtain a seat, and so are included in the outward counts.

It appears to be probable that a certain proportion of passengers use a different means of conveyance in the morning, to that used in the evening.

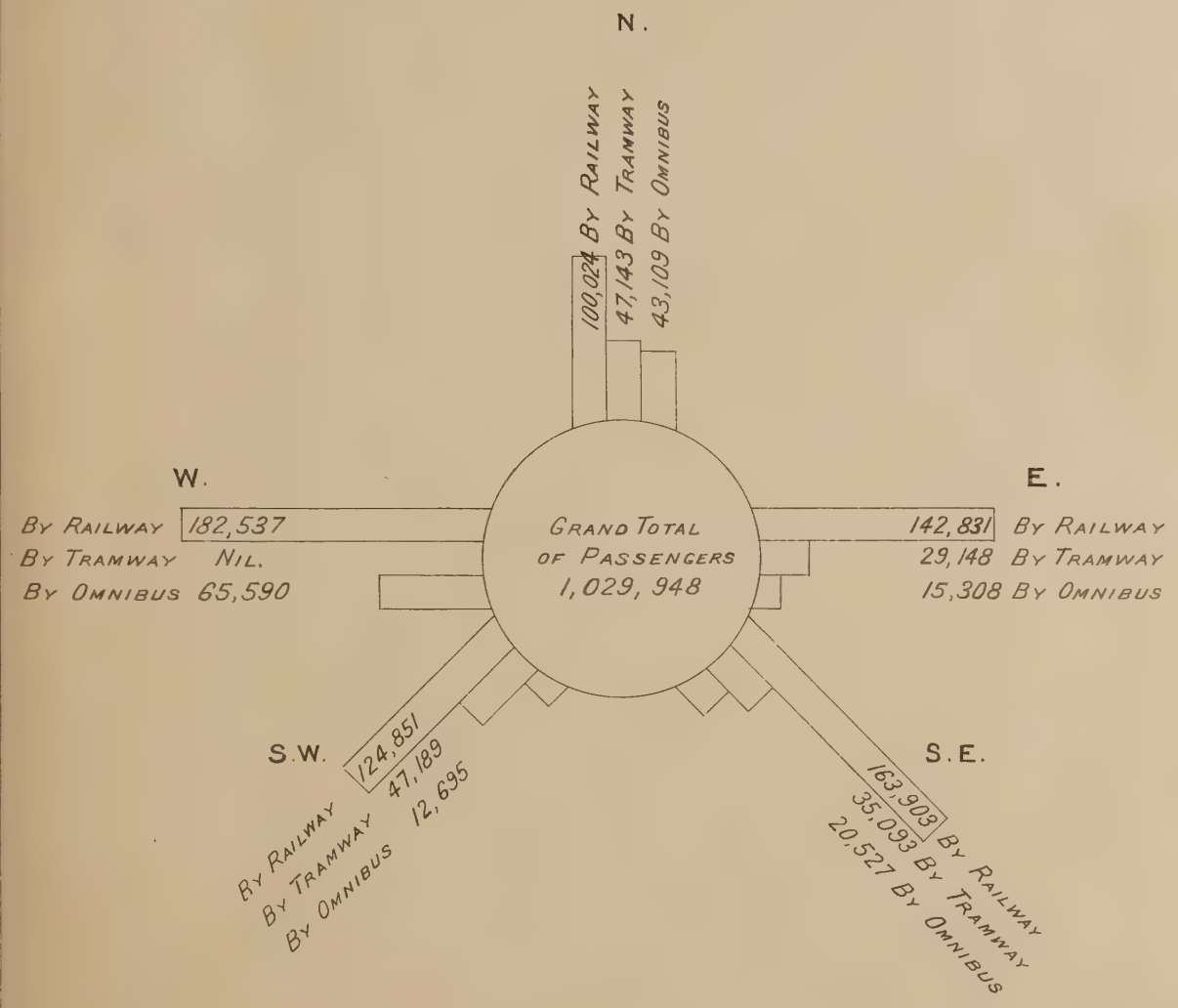
The reason for this may be that owing to work-people's tickets being available for return by any evening train, on some lines of transport, travelling in the evening is accompanied by greater discomfort than in the morning. As a case in point, the traffic on the Central London Railway, given in Table No. 4, may be cited. On this line, on the day that our count was taken, the greatest number of persons entering the "Central Area" in any one hour was 6,637 (between 8 and 9 a.m.), or over 14 per cent. of the total inward traffic during the whole day. The outward traffic reached its maximum between 6 and 7 p.m., when the number was 8,432, or nearly 19 per cent. of the total outward traffic, in spite of the fact that rather fewer passengers appear to have left the "Central Area" than entered it by this line upon that day. Other cases of a similar nature will be noticed in Table No. 4. *Table No. 4.*

A further cause of this disparity between the number of persons using the three classes of conveyance may be that for inward journeys the most

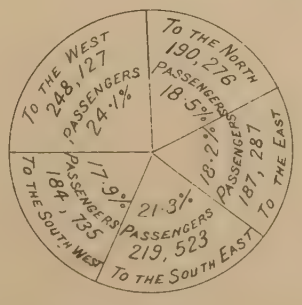
DIAGRAM N° 2.
(See Table N°4.)

ROYAL COMMISSION ON LONDON TRAFFIC.
REPORT OF ADVISORY BOARD.

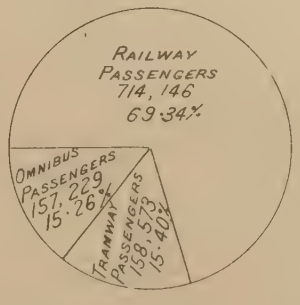
DIAGRAM OF DAILY PASSENGER TRAFFIC FROM THE CENTRAL AREA OF LONDON (ONE DIRECTION ONLY.)



Analyses of Grand Total.



Direction.



Means of Conveyance.

Scale 500,000 Passengers to One Square Inch

5/04 .. 05.
Weller & Graham, Ltd Litho. London.

rapid and direct means of conveyance is used, while for the outward there is less urgency as the day's work is over. But we must again point out that the information is not sufficient for us to be able to say whether this disparity occurs on the majority of days throughout the year

Table No. 4. Tables XV. and XVI.

Points of origin of traffic to "Central Area."

Referring again to the summary of Table No. 4 given in Tables XV. and XVI. on page 22, it appears that, as regards the inward traffic to the "Central Area," the total volume for the day is made up as follows:—From the "Western Section" 24·2 per cent.; from the "Northern Section," 17·9 per cent.; from the "Eastern Section," 18·0 per cent.; from the "South-Eastern Section," 22·2 per cent.; and from the "South-Western Section," 17·8 per cent. As will be seen, the traffic from the "Western Section" is the largest and exceeds that from the south-western, which is the smallest, by nearly 36 per cent., and that from the eastern by nearly 35 per cent. This is somewhat surprising, as it is generally supposed that the eastern district suffers most from pressure during "crush-hours," but it is no doubt explained by the fact that the railway traffic between 7 and 8 a.m. in this section amounts to as much as 17 per cent. of the total against the figures of 9⅓ per cent. for this hour and 16 per cent. for the maximum hour, for all classes of traffic from the whole of London. The maximum traffic from all sections occurs between 8 and 9 a.m., except from the south-eastern, when it is between 9 and 10 a.m. There is no tramway traffic from the "Western Section," but the omnibus traffic from that district is greater than the tramway and omnibus traffic combined in all the other sections except the northern, which is also very largely served by this mode of conveyance. From the eastern, south-eastern and south-western sections the tramway traffic is relatively of greater importance than the omnibus traffic; from the "Northern Section" the number of tramway passengers exceeds that from the eastern and south-eastern, and nearly equals that from the south-western.

Points of destination of traffic from "Central Area."

As regards the outward traffic from the "Central Area," the total volume for the day is made up as follows:—To the "Western Section," 24·1 per cent.; to the "Northern Section," 18·5 per cent.; to the "Eastern Section," 18·2 per cent.; to the "South-Eastern Section," 21·3 per cent.; and to the "South-Western Section," 17·9 per cent. As in the case of the inward traffic the outward traffic to the "Western Section" is the largest, and exceeds that to the south-western, which is the smallest, by over 34 per cent., and that to the "Eastern Section" by over 32 per cent. In all cases, without exception, the maximum traffic occurs between 6 and 7 p.m. The same remarks as to tramway and omnibus traffic apply as for the inward traffic.

Table No. 67

Hour by hour passenger traffic.

In addition to the tables already referred to, one, Table No. 67, will be found in the Appendix (Volume VIII.), which gives the number of passengers arriving and departing during every hour of an ordinary week-day, at all the main-line railway termini and various other important stations. A further table, Table No. 66, gives the traffics at the same points during the whole of the year 1903. In some cases these figures appear to differ from those given in the estimate of traffic to and from the "Central Area" contained in Table No. 4; for, in the former case, the classification of the stations has been according to the section from which the bulk of the short-distance traffic is drawn, while in the latter estimate a closer approximation as to the actual source of traffic has been attempted.

Table No. 66

Table Nos. 69, 70.

Hour by hour passenger traffic on underground lines.

The hourly variations in traffic on the underground and "tube" railways are given in Tables Nos. 69 and 70 in the Appendix (Volume VIII.).

Hour by hour passenger traffic on tramways.

In connection with the tramway section of this report, the number of passengers travelling to and from various termini is given in the Appendix (Volume VIII.) as already referred to. In this case, also, apparent discrepancies will be found between the figures given and those in the estimate of traffic to and from the "Central Area" for the same reason as that given with respect to the railway traffic.

Per capita journeys in London.

In dealing broadly with the local traffic of towns the total number of passenger journeys per head per annum of the population by local means of conveyance offers some index to the efficiency and sufficiency of the means of locomotion, and is a convenient standard for comparison with other cities.

From the data we have collected, it seems that the total traffic by the public local means of conveyance in "Greater London" is as follows :—

TABLE XVII.

APPROXIMATE TOTAL LOCAL YEARLY PASSENGER TRAFFIC IN "GREATER LONDON."

	Number of Passenger Journeys.
Railways—Local lines (not trunk lines)*	301,000,000
Tramways	405,000,000
Omnibuses	458,000,000
Estimated total number of passenger journeys in "Greater London" by above means of conveyance during the year ending June 30th, 1904	1,164,000,000

* These lines include :—The Metropolitan, Metropolitan District, Whitechapel and Bow, Hammersmith and City, West London and West London Extension, East London, North London, Central London, City and South London, Great Northern and City, and the Waterloo and City.

Assuming the population of "Greater London" at 6,850,000 according to the last census plus the estimated increase since the date thereof, the number of local passenger journeys by such conveyances per head per annum of the population is thus 170.

Comparing this with Mr. Harper's[1] estimate we notice that he gave a figure of 136 on the basis of actual returns, but stated that the inclusion of those journeys for which he had no returns or by other means of conveyance which he had not included would probably bring the figure up to at least 200.

Per capita journeys in Paris, Berlin, and New York.

The per capita journeys by corresponding means of conveyance in Paris are 200, in Berlin 270, and in New York 300. (See Diagram No. 76, facing page 76). Diagram No. 76.

London behind in per capita journeys.

Thus, London is undoubtedly behind foreign towns in the number of journeys per capita per annum, apart from any consideration of the convenience and rapidity of the means of locomotion.

Speed of vehicles.

As touching the question of the movement of persons and goods in London a most important point is the speed of the vehicles affected by the condition of the streets. Dealing first with the "Central Area," we submit the following table, giving the observed speed of various classes of vehicles in the streets, and also upon the local underground railways :

TABLE XVIII.

SPEEDS OF VEHICLES, TRAMCARS AND TRAINS IN THE "CENTRAL AREA" OF LONDON.

Class of Vehicle.	Speed during "crush-hours."	Speed during slack hours.	*See also* Table in Appendix.
	Miles per hour.	Miles per hour.	
Traction-Engines	2	2	—
Heavy Vans	2½	3	—
Light Vans	4 to 6	6 to 8	—
Omnibuses :			
Horse	3½ to 6	5¼ to 8	Nos. 5 and 6
Motor	6½ to 8¼	8¼ to 11½	No. 6
Cabs :			
Horse	3½ to 6	6 to 8½	—
Motor	8	12	—
Tramways :			
Horse	2 to 5	5½ to 8	No. 7
Electric	5¼ to 7	8½ to 11½	No. 7
Steam Railways :			
"Inner Circle"		10·72	
Metropolitan District Railway branches		14·15 (average)	
Metropolitan Railway branches		17·21 (average)	
Electric Deep-Level "Tubes" :			
City and South London		13·30	
Central London		13·80	
Great Northern and City		16·15	
Waterloo and City		18·00	

Mr. Edgar Harper, Q. 4595, Vol. II.

ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

DIAGRAM SHOWING THE HOURLY VARIATION IN PASSENGER TRAFFIC TO AND FROM THE CENTRAL AREA OF LONDON BY RAILWAY, TRAMWAY, AND OMNIBUS, DURING THE WHOLE OF A TYPICAL WEEK-DAY.

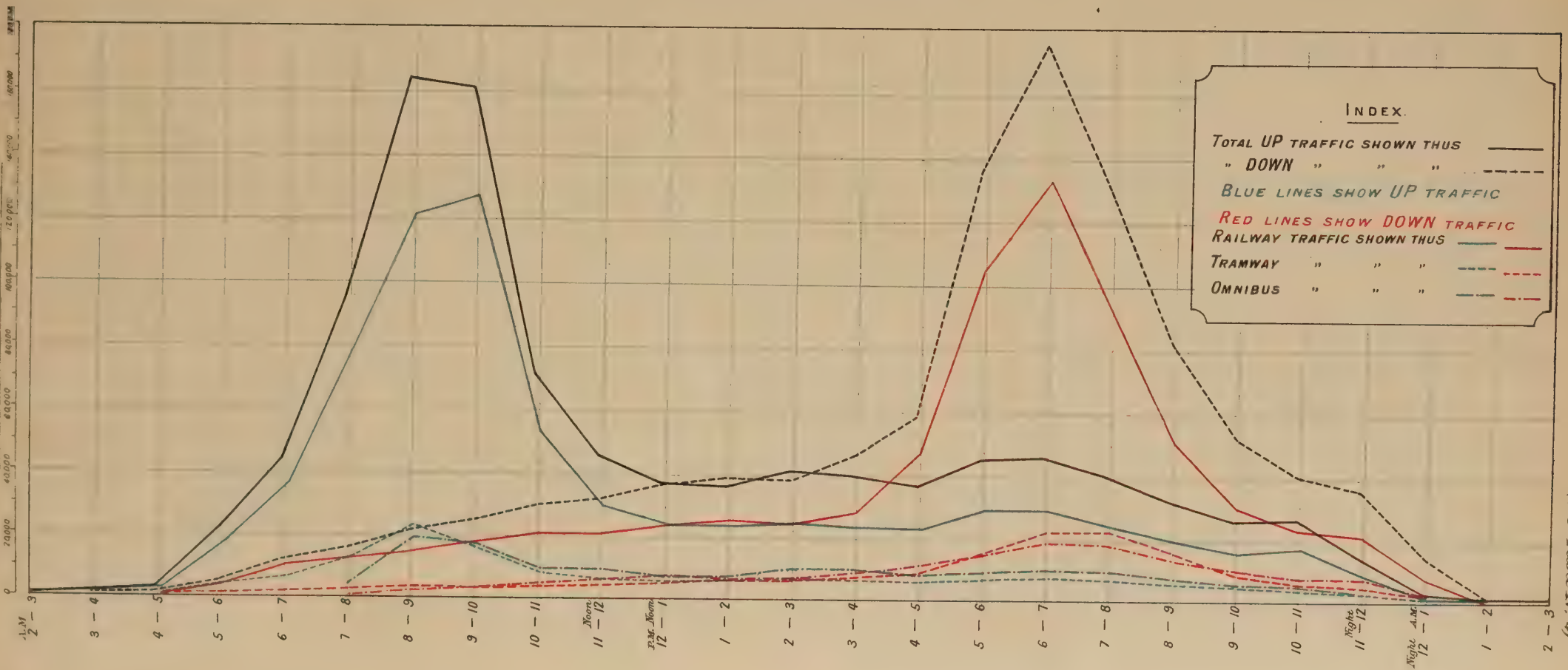


DIAGRAM No. 3.
(See Table No. 4.)

Weller & Graham, Ltd. Litho London.

TABLE XIX.

SPEEDS ON CERTAIN OTHER ELECTRIC RAILWAYS.

	Miles per hour.
Liverpool Overhead	19·0
Chicago, South Side Elevated	14·6
New York, Subway (express)	30·0
New York, Subway (local) and Elevated	15·0
Chicago, Lake Side Elevated	12·5

Tables of speeds in the streets.

Except in the "Central Area" it seems unnecessary to consider the present speed of goods vehicles as the question of speed has probably little effect on the other traffic in the remainder of "Greater London."

Speed of traction engines and motor vans.

Traction engines are limited by Act of Parliament to the speed of two miles per hour given in Table XVIII., which it appears to us might very well be increased. There are, moreover, at the present time a number of mechanically-propelled vehicles in use forming an intermediate class between the traction engine and the light motor van which are taking the place of the heavy horse van. We understand that the claims of this class of traffic have been recognised by the Local Government Board, and that an order has been issued authorising a reasonable speed. Of this we venture to express our approval, as there is no doubt that these vehicles perform useful services.

Speeds of heavy and light horse vans.

The speeds of heavy and light horse vans are given from general observation, but in the case of horse omnibuses and cabs we have availed ourselves of the evidence[1] given by the City Solicitor, Sir Homewood Crawford. *Table No. 5.* In the Appendix (Volume VIII., Table No. 5), in addition, will be found a detailed statement of the average speed of horse omnibuses on the route between Clarges Street, Piccadilly, and the Bank, *via* Charing Cross and Queen Victoria Street, which, besides generally bearing out the figures in Table XVIII., shows that the general effect of police delays at important crossings upon the average speed of this class of vehicle is not so great as might perhaps be expected, owing partly to the low speed possible in the more crowded streets of the "Central Area," and partly to the fact that the compulsory stoppages at the crossings occur for the most part at points where the omnibuses always stop to pick up and set down their passengers.

Speeds of motor omnibuses and their important bearing on railway and tramway policy.

In the case of motor omnibuses the figures are derived from observations we have made of the few motor omnibuses now running between Peckham and Oxford Circus, and from Oxford Circus *via* Holland Park Avenue to Hammersmith, and those running from Piccadilly Circus to Hammersmith and along the Edgware Road. It will be seen that the motor omnibuses, the average speed of which compares favourably with that of tramcars, are materially faster than omnibuses drawn by horses, and if they should come into general use will greatly improve the speed of the present omnibus service. If it be found that these vehicles can be economically worked and maintained at the speeds given in the Appendix (Volume VIII., *Table No. 6.* Table No. 6), we think they will have an important bearing upon the transport of passengers in London, and may affect the consideration of railway and tramway policy. We refer again to this subject on page 87.

Speeds of tramway cars.

The speed of cars upon representative horse and electric tramways in *Table No. 7.* London is set out in Table No. 7 in the Appendix (Volume VIII.), from which it will be seen that the speed upon horse lines within the "Central Area" varies from 2 to the maximum speed of 8 miles an hour, and in the case of electric lines from 5½ to 8 miles an hour; while in outlying districts the electric tramcars reach the maximum speed allowed by the Board of Trade, viz: 10 to 12 miles an hour, in this respect being at a disadvantage as against motor omnibuses, which coming under the Motor Car Act, 1903, may have a higher limit. The lowest speed actually observed on electric tramways was on the section immediately west of Hammersmith Broadway, on the London United

King Street, Hammersmith

[1] Sir Homewood Crawford, Appendix No. 79, Table B, Vol. III.

system. This section is some distance from the "Central Area," but the road at the point mentioned is narrow and much congested by other traffic as well as by costermongers' stalls.

Lieut.-Col. Yorke on speeds of tramway cars in crowded streets. Indication that brakes are being applied.

We would direct attention to the evidence[1] of Lieut.-Col Yorke on the low speed of tramway cars in crowded streets in New York, Manchester, Glasgow and other large cities.

In the increasing development of mechanical traction some means should be compulsory for indicating at the rear of the vehicle for the information of the vehicles following that the brakes are being applied, as owing to conductors having a variety of duties to perform they cannot always be relied on to give this necessary information.

Speeds on railways.

Comparatively low speeds are attained by the local underground railways now worked by steam as well as by the "tube" lines worked by electricity, but in this connection it will be remembered that the service on the "Inner Circle" Railway is expected to be accelerated when it is electrified.

Effect of frequent stations on speed.

But frequent stations are incompatible with high speeds, and the higher speed attained on the Waterloo and City Railway is accounted for by the absence of intermediate stations, and on the branches of the Metropolitan and Metropolitan District Railways by the greater distance apart of stations compared with their "Inner Circle" lines. The greater speed on the Metropolitan Railway branches as compared with the Metropolitan District Railway branches is due to the same cause.

In the case of passenger traffic outside the "Central Area," we have caused observations to be made, from which Table No. 7 in the Appendix (Volume VIII.) has been prepared. This table shows the speed on different sections of a number of the chief tramway routes radiating from the "Central Area," and the general effect of the width of the streets traversed and of the volume of other traffic therein on speed. In addition to these statistics, we give in Table XX. following, examples of the duration of representative journeys to the "Central Area" from different parts of "Greater London": *Table No. 7*

TABLE XX.

TYPICAL JOURNEYS from the Suburbs to the "Central Area" by Tramway, Railway, and Railway and Tramway.

District.	Time taken in Minutes.	Distance in Miles.	Rate of Speed of Journey in Miles per Hour.
Finchley to Broad Street, by Great Northern and North London Railways	37 (ordinary train) 29 (fast train)	9·25	15·00 19·12
Enfield to Liverpool Street, by Great Eastern Railway	43 (ordinary train) 27 (fast train)	10·74	15·00 23·90
Acton (corner of Horn Lane) to the Bank, by Tramway (2·50 miles) and Central London Railway	19 tramway 3 change 25 tube 47 total	8·25	10·53
East Ham to Fenchurch Street, by London, Tilbury and Southend Railway	26 (ordinary train) 16 (fast train)	6·00	13·85 22·50
Carshalton to London Bridge, by London, Brighton and South Coast Railway	41 (ordinary train) 24 (fast train)	12·80	18·75 32·00
Lower Tooting to the Bank, by Tramway (2·65 miles) and City and South London Railway	20 tramway 3 change 18 tube 41 total	6·85	10·00
Lower Tooting to Westminster Bridge, by Electric Tramway	45	5·92	7·89

[1] Lieut.-Col. Yorke, Qq. 480-481, Vol. II.

TABLE XX—*continued.*

TYPICAL JOURNEYS from the Suburbs to the "Central Area" by Tramway, Railway, and Railway and Tramway.

District.	Time taken in Minutes.	Distance in Miles.	Rate of Speed of Journey in Miles per Hour.
Raynes Park to the Bank, by London and South Western Railway and Waterloo and City Railway -	Ordinary train— 26 train 5 change 5 tube — 36 total	9·25	15·41
	Fast train— 19 train 5 change 5 tube — 29 total	9·25	19·13
Richmond to the Bank, by London and South Western Railway and Waterloo and City Railway - - -	Ordinary train— 34 train 5 change 5 tube — 44 total	11·00	15·00
	Fast train— 19 train 5 change 5 tube — 29 total	11·00	22·80
Richmond to Mansion House, by Metropolitan District Railway - -	51	10·50	12·35

Thus, the rate of speed of journey from the outskirts of London to the "Central Area" varies from ten to thirty-two miles per hour, depending on the greatly differing speeds of stopping and non-stopping trains. From the table it seems fair to assume that it occupies on the average forty minutes to travel ten miles from the various London termini, and if to this be added an allowance for walking of ten minutes at each end of the journey, we arrive at a total expenditure of two hours daily for the double journey. When it is remembered that quite as long a time may be occupied in covering the shorter distance of six or eight miles from many intermediate points, and that London is continuously growing, and is already deemed to cover a diameter of 30 miles, the present condition of affairs cannot be considered satisfactory. An expenditure of time of two hours per day is a serious matter to any working man and indeed to anyone engaged in business. As this condition also no doubt materially contributes to the overcrowding of many of the poorer districts of London, as brought out in evidence before the Royal Commission by the Statistical Officer to the London County Council, we think that every means should be taken to accelerate the means of transport between the "Central Area" and the suburbs.

Time taken to reach "Central Area" from suburbs.

With these introductory and general remarks we propose to deal with the questions submitted to us under the three heads set out in the terms of the reference by the Commission to the Advisory Board, viz., (1) Streets, (2) Tramways, (3) Railways. In discussing the matters involved we are not always able entirely to keep the three subjects under distinct heads, as, from the nature of things, they all are more or less inter-dependent, but we have endeavoured as far as possible to report our views for the improvement of travelling facilities in London separately under each of these chief heads.

Ante page xi.

Traffic questions dealt with under three heads, viz., (1) Streets, (2) Tramways, (3) Railways.

STREETS.

In approaching the important subject of street improvements, one fact stands prominently forward, viz., that comparatively little has been done during the past thirty years in the piercing or widening of new arterial streets in the central districts of London, that is to say within the area bounded on the north by the Regent's Canal, on the south by the Old Kent and Rotherhithe Roads, on the east by Leman Street, and on the west by the Edgware Road.

Little done to improve streets during past thirty years.

We do not intend to suggest that nothing has been effected in central London, but few improvements have been carried out of such an important nature as the Holborn Viaduct, Cannon Street, or the Victoria Embankment, which date from somewhat earlier years. Eastcheap and Great Tower Street were widened in 1884, Charing Cross Road and Shaftesbury Avenue were made about 1887, and Rosebery Avenue in 1890–2, but all these last mentioned, though valuable in themselves as replacing narrow tortuous streets, are more or less local in character, and are already beginning to be overcrowded.

Improvements local in character.

In the meantime, the demands of the ever-increasing influx and efflux of the inhabitants of the suburbs to and from the area under consideration has greatly increased the demand not merely for better means of reaching the suburbs, but, also, even to a greater degree, for what may be termed urban inter-communication. It was hoped that "tube" railways would meet this latter necessity, but it is clear that they cannot do so, and experience has shown that, by bringing in more and more people from the immediate suburbs the development of railways in London has increased the congestion of the streets themselves. Thus the question of improving the means of street locomotion is inseparably connnected with the problem of London traffic which has to be faced, and, whether it be generally recognised or not, we are persuaded that no real improvement of the present congestion of traffic of internal London, with sufficient means of providing for inter-communication between central and suburban London and provision for future wants, can be hoped for unless we are prepared to undertake large and important street improvements.

Street improvements the root of the problem of London traffic.

The streets which we have in our mind would be such as, while providing for the ordinary vehicular, motor and pedestrian traffic, would also enable tramways to traverse London in all important directions. New direct streets of ample width would further provide means, by new railways to be constructed beneath them, of linking up the great systems of railways which give access to the suburbs. Underground tramways also on certain lines of streets would be possible, and some special provision for quick motor traffic might, in addition, be practicable.

What new streets would provide.

Provision for these latter objects could be obtained under the roadway of new and widened streets, the substructure of which could also provide space for subways for pipes, electric mains and pneumatic tubes, and minimise the breaking up of the roadways.

What the substructure of new streets should provide for.

It is thus necessary, in considering the problem of wider streets and their cost, to bear in mind that, if it be solved, many other subjects would also be determined, all of which are urgent.

Wider streets would determine many subjects.

The following Table XXI. gives the widths of some of the most important streets in London, and a more detailed table (Table No. 8), also including the width of the bridges over the Thames, will be found in the Appendix, Vol. VIII.

ble No 8.

Widths of London streets.

TABLE XXI.

WIDTHS OF CERTAIN STREETS IN LONDON.

Name of Street.	Widths.		Point where measured.
	Total.	Roadway.	
	Ft. In.	Ft. In.	
Aldersgate Street	52 1	30 6	By City Boundary.
	48 0	26 5	South of Barbican.
Brixton Road	97 0	50 0	Loughborough Road.
	53 0	35 0	Mostyn Road.
Cannon Street	62 0	37 6	Queen Victoria Street.
	49 8	32 6	Next King William Street.
	mostly 54 0	30 0	
	50 9	30 1	By Laurence Pountney Lane.
Chancery Lane	37 0	19 6	North of Record Office.
	28 6	18 6	80 feet south of Holborn.
Cheapside	60 6	41 10	Nos. 78 to 84.
	48 4	32 0	Near Bow Church.
	mostly 57 0	36 0	
Cornhill	62 2	35 6	Change Alley.
	38 11	21 6	St. Michael's Church.
Edgware Road	104 0	36 0	Rondu Road.
	57 6	32 6	At Junction of Harrow Road.
Fleet Street	61 5	42 3	East of Fetter Lane.
	48 0	35 10	Red Lion Court and East of Shoe Lane, generally widening to 60 feet.
Kingsway	100 0	64 0	
Ludgate Hill	60 5	38 0	Opposite Benson's.
	57 8	41 0	East of Old Bailey.
	57 2	39 0	By Old Bailey.
Moorgate Street	51 6	31 0	South of London Wall to Lothbury.
	51 0	29 6	By King's Arms Yard.
New Cross Road	86 0	51 0	Broadway and Pepys Road.
	46 0	33 0	Wilson Street.
Oxford Street	88 0	52 0	North Audley Street.
	58 0	36 0	At Post Office, near Oxford Music Hall.
Park Lane	117 0	101 0	Hertford Street—north corner.
	26 9	17 0	Piccadilly end.
Piccadilly	136 4	106 0	East corner of Hamilton Place.
	54 6	34 0	Corner of Piccadilly Circus.
	75 0	49 0	From Green Park to Arlington Street.
	55 0	35 0	From the Circus to Sackville Street.
Queen Victoria Street	66 0	43 6	West of Queen Street.
	49 7	29 6	South of Cannon Street.
	mostly 70 0	46 0	
	69 7	46 8	By Bennet's Hill.
Regent Street	87 6	54 0	South of Oxford Circus.
	84 0	52 0	Beak Street.
Strand	100 0	60 0	At Eastern Horn of Crescent. (Wellington Street to Law Courts).
	85 2	59 9	Hotel Cecil—west end.
	52 6	32 0	Agar Street.
	117 3	79 0	Between Churches of St. Mary le Strand and St. Clement Danes, absorbing Holywell Street.
	80 5	55 8	Savoy Hotel—east end.
Uxbridge Road	82 0	43 0	Holland Park.
	75 0	39 0	Addison Road.
Westminster Bridge Road	84 3	49 0	St. George's Circus.
	59 0	38 0	Near Oakley Street.

Widths of certain streets in foreign cities.

It is very interesting to compare the above table with the widths of main thoroughfares in Continental and other cities, of which we give some particulars below: it will be seen how far behind in this respect is London.

TABLE XXII.

WIDTHS OF CERTAIN STREETS IN CONTINENTAL AND OTHER CITIES.

Name of City and Street.	Widths. Total.	Widths. Roadway.	Remarks.
BERLIN.	Ft. in.	Ft. in.	
Unter den Linden	196 0	30 6 19 0 21 0 35 0	Side road. Carriage-way. Horse-way. Side road.
	196 0	42 6 13 0 32 9	Side road. Horse-way. Side road.
Leipziger Strasse	72 0	42 6	
Friedrich Strasse	72 0	43 6	
„ „	41 0	26 3	From the corner of Behren Strasse to Unter den Linden.
König Strasse	57 0	32 9	
BRUSSELS.			
Le Boulevard Circulaire	247 0	95 0 26 0 36 6	Central roadway. Side roadway. Side roadway.
L Avenue Louise	180 9	49 0 19 0	Central roadway. Two-side roadways.
L'Avenue du Midi	121 0	65 6	
Le Boulevard Anspach	92 0	52 6	
Le Boulevard du Nord	77 6	49 0	
PARIS.			
Rue de Rivoli	72 0	39 0	Between la Rue François Miron and the Tuileries Gardens.
„	69 0	53 6	At the Tuileries Gardens.
Rue Montmartre	74 0	48 0	At the Rue Saint Marc.
„	45 0	25 6	Near the Grands Boulevards.
Avenue de l'Opéra	98 6	52 6	
Grands Boulevards	114 9	54 6	
Avenue des Champs Elysées	233 0	88 6	
„ de Grande Armée	229 6	52 6 25 0	Centre roadway. Two-side roadways.
„ Bois de Boulogne	393 8	52 6 19 6	Centre roadway. Two-side roadways.
VIENNA.			
Ringstrasse	187 0	47 0 21 6	Centre roadway. Two-side roadways.
Kärntnerstrasse (Upper)	62 0	32 9	
„ (Lower)	121 0	87 0	
Praterstrasse	118 0	46 0	
NEW YORK.			
Broadway	71 0	35 0	Opposite Rector Street.
Broadway	80 0	44 0	Mostly.
Broadway	150 0	102 0	60th Street to Kingsbridge Road, 5½ miles.
Fifth Avenue	100 0	40 0	Proposed to widen roadway. No tramways.
WASHINGTON.			
Virginia Avenue	160 0	50 0	
Maryland „	160 0	50 0	
Pennsylvania „	160 0	107 6	

Widths of new streets and widenings.

Before discussing the routes of streets which we recommend for earnest attention, it seems desirable to consider the widths of new streets which ought in future to be undertaken, or to which existing streets should be widened. We should divide these into:—

"Main Avenues."

(1.) "Main Avenues," arterial in their conception and traversing London from side to side, with the substructure fully occupied for all the purposes which we have mentioned, viz., by railways and subways of various kinds.

"First-class Arterial Streets."

(2). "First-class Arterial Streets," forming trunk lines of communication, but in situations in which circumstances prevent or render unnecessary the adoption of the dimension of "Main Avenues," and in which the demand for substructural accommodation may be less in amount than in the "Main Avenues."

"Second-class Streets."

(3). "Second-class Streets," which would include new main streets contributing to the above, in the substructure of which there would be space for cellars and pipe subways, and, if need be, for at least one underground double line of tramway or railway.

"Third-class Streets."

(4). "Third-class Streets" which would include all other new streets and widenings for local purposes in the crowded parts of London, as distinguished from streets, which are in the true sense of the word thoroughfares, and from suburban streets. The substructure of these streets would provide for subways for pipes, and possibly for a double line of sub-surface tramways.

"Fourth-class Streets."

(5). "Fourth-class Streets" for more sparsely populated districts, where their use can only be local or contributory to other streets, and which are mainly required for the development of building operations, as distinguished from being necessary for through lines of communication.

Height of buildings should be proportionate to width of street.

In approaching the subject of the width of "Main Avenues" and of streets of the first and second class, the question of provision for traffic is of chief importance. When the width from house to house for this purpose is settled, the height of the buildings adjoining, should, under ordinary sanitary laws, be proportioned to it, but, to enable this to be carried out, it would seem that some modification of the London Building Act, 1894, which we consider to be over-restrictive, would be necessary.

Stationary vehicles at sides of streets.

Dealing then with the space required for vehicles, we think that the question of vehicles stationary at the kerbstones for the purpose of loading and unloading has up to the present time been too much disregarded. The business of a great city demands this accommodation, and the width so taken out of the space available for moving vehicles should not be estimated at less than 8 feet on each side or 16 feet in all.

Road traffic which "Main Avenues" should provide for.

We think in "Main Avenues" provision should be made for standing vehicles at each kerb, two lines of slow vehicular traffic, two lines of frequently stopping tramway cars, four lines of fast vehicular traffic, and two lines of rapid transit tramway cars at the centre of the roadway: the above would require a width of roadway of 94 feet.

Total width of "Main Avenues."

The footways should be 23 ft. wide, and we arrive in this way at a total width of 140 ft. for surface traffic in the case of "Main Avenues." An example of such a street, as to width, is Whitehall, opposite to Downing Street.

Tramways on new streets.

Ordinarily it is not necessary to consider tramways as exclusively occupying any portion of a street. Tramcars are like omnibuses, public conveyances available for hire by great numbers of the people, for whose use streets are constructed. Though running on fixed lines, other vehicles can pass along between following cars, and in the second place, owing to their higher speed and greater size fewer tramcars than omnibuses suffice for the same amount of traffic. As regards new streets one of the things to be aimed at is for tramcars to be as little as may be interfered with by other traffic, and so to improve the speed of their transit in London. It has been forcibly pointed out that when tramcars have to thread their way through crowded streets, the speed becomes very slow. Further than this, when a tramway has been authorised no restriction of user has, so far as we know, ever been made, nor, in the nature of things, would it be wise to do so. If any such restrictions were at first enacted so as to allow for a

SKETCH SHOWING SUGGESTED MAIN AVENUE

CROSS SECTION.

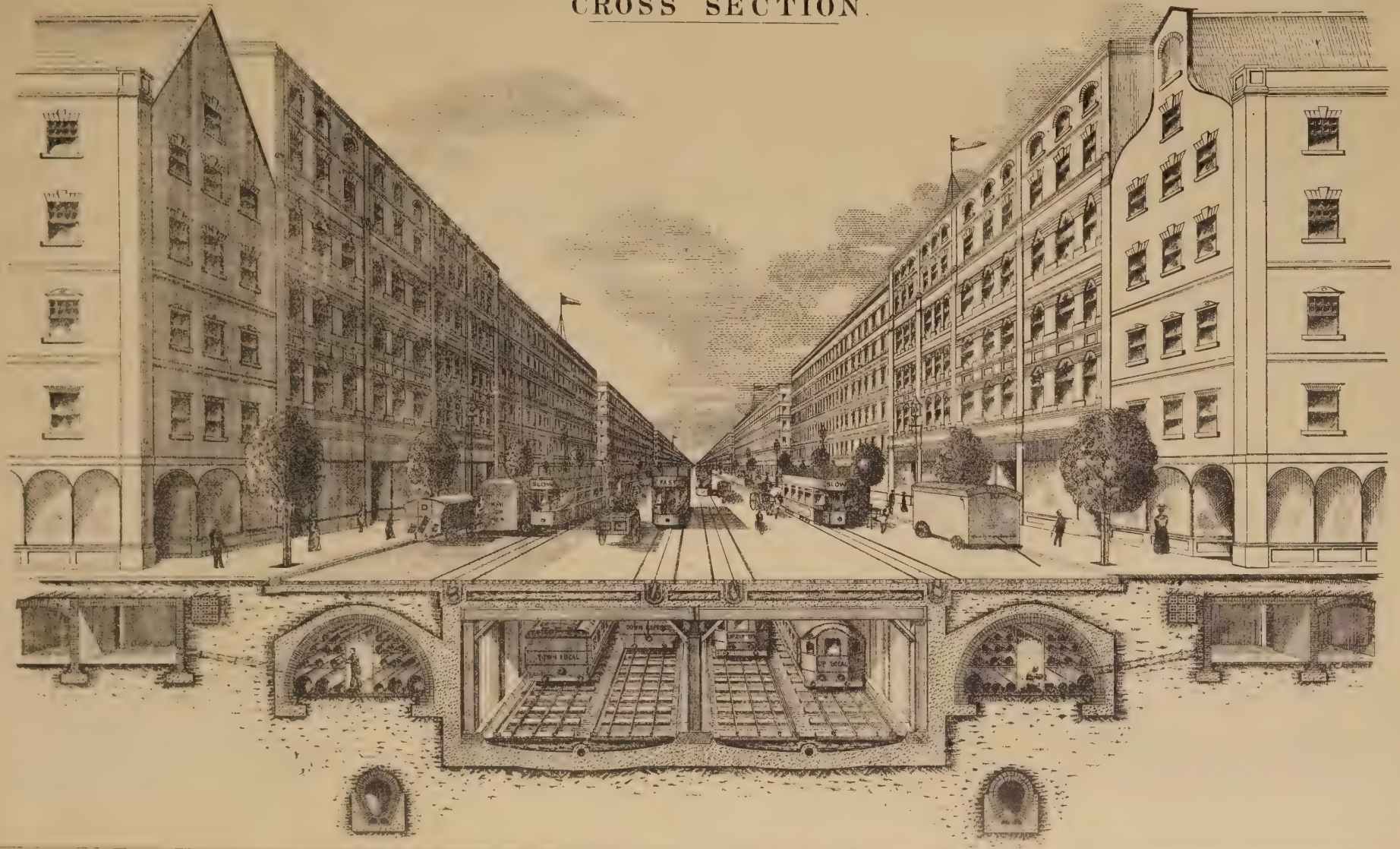


PLATE No 1

Weller & Graham, Ltd Lith. London

SKETCH SHOWING SUGGESTED FIRST CLASS ARTERIAL STREET

CROSS SECTION.

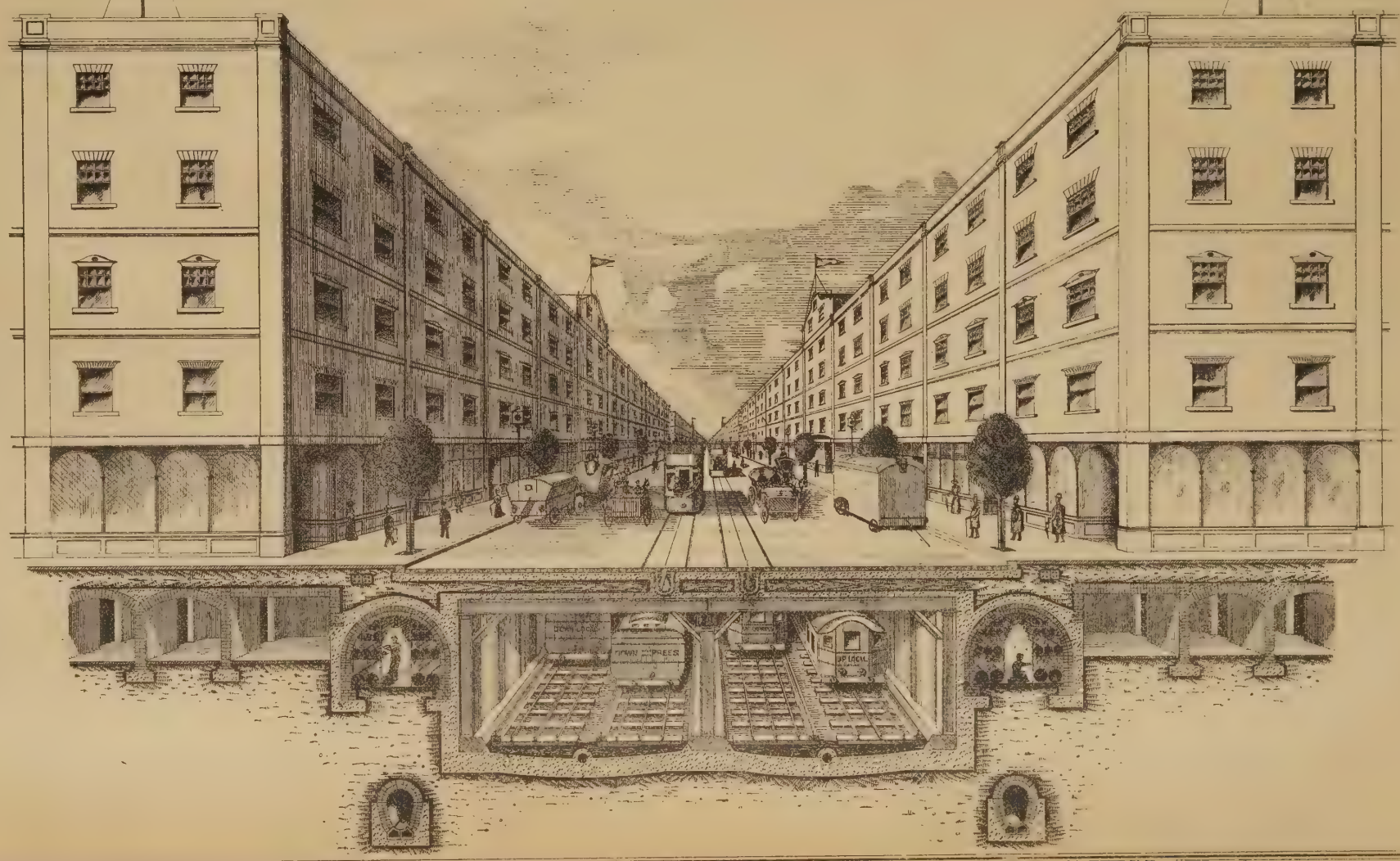


PLATE No 2.

5104. 3 05.

Wetter & Graham, Ltd Litho. London

practicable and convenient use of the tracks by other vehicles it is obvious that with the growth of traffic the limitations of user would soon be swept aside. Thus in considering the widths of future streets through the central parts of London we will not say that the ability of ordinary vehicles to use the tramways is to be disregarded, but that we must look forward to so frequent a passage of tramcars in busy streets that the portion of the street devoted to them could be but little used by ordinary vehicles except as affording some slight relief to the other vehicular traffic of the streets in question.

Width of "First-class Arterial Streets."

In a "First-class Arterial Street" we should provide space for standing vehicles at each kerb and four lines of moving vehicles, and with two lines of tramways we should require, between the kerb-stones, 64 feet. To this should be added 18 feet for each footway, and we arrive at a total width, from house to house, of 100 feet. The portion of the Strand opposite to Norfolk Street is an example of a width of street of 100 feet.

Width of "Second-class Streets."

In "Second-class Streets" there should be space for two lines of standing vehicles and two lines of moving vehicles, and a double line of tramway. These, with footways 16 feet wide, would require a total width of 80 feet. The Strand opposite to the Hotel Cecil is about 85 feet wide.

Width of "Third-class Streets."

With regard to "Third-class Streets" we are of opinion that the width of these should not, in future, be less than 60 feet from house to house, within an area to be prescribed, which would embrace the strictly urban districts. This would provide for at least four lines of vehicular traffic, or two lines of tramways and two lines of ordinary vehicles, with proper footpaths. We arrive at this width as a minimum for future new streets not merely from considerations of traffic but also from the requirements of sanitation and health.

Height of buildings.

Having regard to the requirements of London, and the developments of lifts, we anticipate that very few houses in the future will in central London be built less than about 60 feet high, while in main thoroughfares the height could, under modern conditions, be much greater. For this reason, apart from the demands of traffic, we think a minimum width of 60 feet should be adopted for all "Third-class Streets." The width of 60 feet may be divided into a roadway of 36 feet and two footpaths of 12 feet each. Shaftesbury Avenue, though too narrow for its position, is an example of a street of that width.

Width of "Third-class Streets."

Width of "Fourth-class Streets."

"Fourth-class Streets," which are merely for the development of suburban building land, should in no case be less than 40 feet wide, and 50 feet would be in many cases more desirable.

Table of widths of new streets and widenings.

To sum up the consideration of the standards for new streets in London we should recommend the following widths :—

TABLE XXIII.

WIDTHS FOR NEW STREETS.

Class of Street.	Each Footway.	Roadway.	Full Width.
	Feet.	Feet.	Feet.
"Main Avenues"	23	94	140
"First-class Arterial Streets"	18	64	100
"Second-class Streets"	16	48	80
"Third-class Streets"	12	36	60
"Fourth-class Streets"	8	24 or 34	40 or 50

Utilizing substructure of new streets.

Such being our views on the width of streets required for surface traffic, we now approach the purposes to which the substructure of the streets could be devoted.

Provision for cellarage beneath the pavement is almost universally customary in London. Though, at first sight, this may appear to be an encroachment on public property, we think that any other arrangement of cellars would give rise to greater public inconvenience. Coals and bulky articles must be provided for; convenient access to house drains, pipes,

etc., is required between the main sewers under the street and the drains of the house itself; and some ventilation of the basement of the house is a necessity. The lack of cellar accommodation beneath the public footway would seriously detract from the value of property fronting it, of which property the municipality will be the owner frequently in the case of new streets.

Distance that cellars should project.

It is usual in London to allow cellars to project as far as the kerb-stone. In "Third-class Streets" this principle might be adopted, but we think that in "Main Avenues" and "First" and "Second-class Streets" the projection of cellars might be somewhat less than the width of the footways, say 12 feet, if the other purposes to which the substructure of the street is to be devoted require more than the space occupied by the roadway.

Pipe subways.

The next matters to be provided for are subways for water mains, gas mains, electric conduits, hydraulic mains, and other similar necessities of modern life. There should be, wherever possible, such a subway on both sides of the street in order to avoid expensive, troublesome, and obstructive cross subways between the mains and the houses. The width of each subway should be from 10 feet to 15 feet.

Substructure of "Main Avenues" and streets.

Taking, then, a "Main Avenue," the cellars and pipe subways will, with their supporting walls, occupy a width of about 66 feet out of 140 feet, and this would leave sufficient space for a full-sized electrical railway of four lines of way. (*See* Plate No. 1, facing page 32.) Similarly, in a "First-class Street" with narrower cellars and pipe subways there would be room for four lines of electrical railway. (*See* Plate No. 2, facing page 33).

Plate No.

Plate No.

Beneath "Second-class Streets" there would be space for a double line of electrical railway with cellars and pipe subways of the dimensions above given.

Electrical railway or tramway subway.

In all the above cases in which an electrical railway is spoken of there would be more than sufficient space for what, as an alternative, is in places greatly required, viz., a subway for uniting systems of tramways which cannot be accommodated on the surface of the street in question. In "Third-class Streets," to arrange for a sub-railway, pipe subways, and cellars, special designs must be made, while in "Fourth-class Streets" the substructure would only provide space for cellars and subways for pipes if required immediately beneath the roadway.

Electrical railway as close as possible to surface of streets.

We would point out that, in our opinion, the lines of electrical railway should be as close to the level of the street as possible, and that the sub-structure of new streets should be specially designed to meet this view.

Advantages of having railway stations close to surface of streets.

Railways so designed can have the station platforms within 14 or 16 feet of the street surface, and are thus obviously the most convenient for public use. As lifts are not required, the initial cost of constructing such stations, and the subsequent expense of working, are much less than for similar items with deep "tube" stations. If these "shallow" subways are for tramways, frequent stations of simple character are required. If the subways are to be used for trains carrying passengers further than the urban districts, stations should be at greater intervals, so as to get higher speeds, while, if a four track subway is to be constructed, a combined local and express service can be laid out with frequent stops on one line and few stops on the other. (*See* Plate No. 3, facing this page, and Plate No. 4, facing page 35). This is the feature that has marked the success of the recently completed subway in New York. (*See* Plate No. 5, facing page 36).

Distance apart of stations.

Plate Nos. 3 and 4.

Plate No.

Short distance urban traffic by tramway and roadway vehicles.

We are convinced that, generally speaking, the accommodation of urban traffic for short distances should be by means of surface tramways or motor omnibuses, which offer for these purposes advantages beyond the reach either of ordinary railways approached by flights of stairs, however short, or by deep lifts, as in the case of "tube" railways.

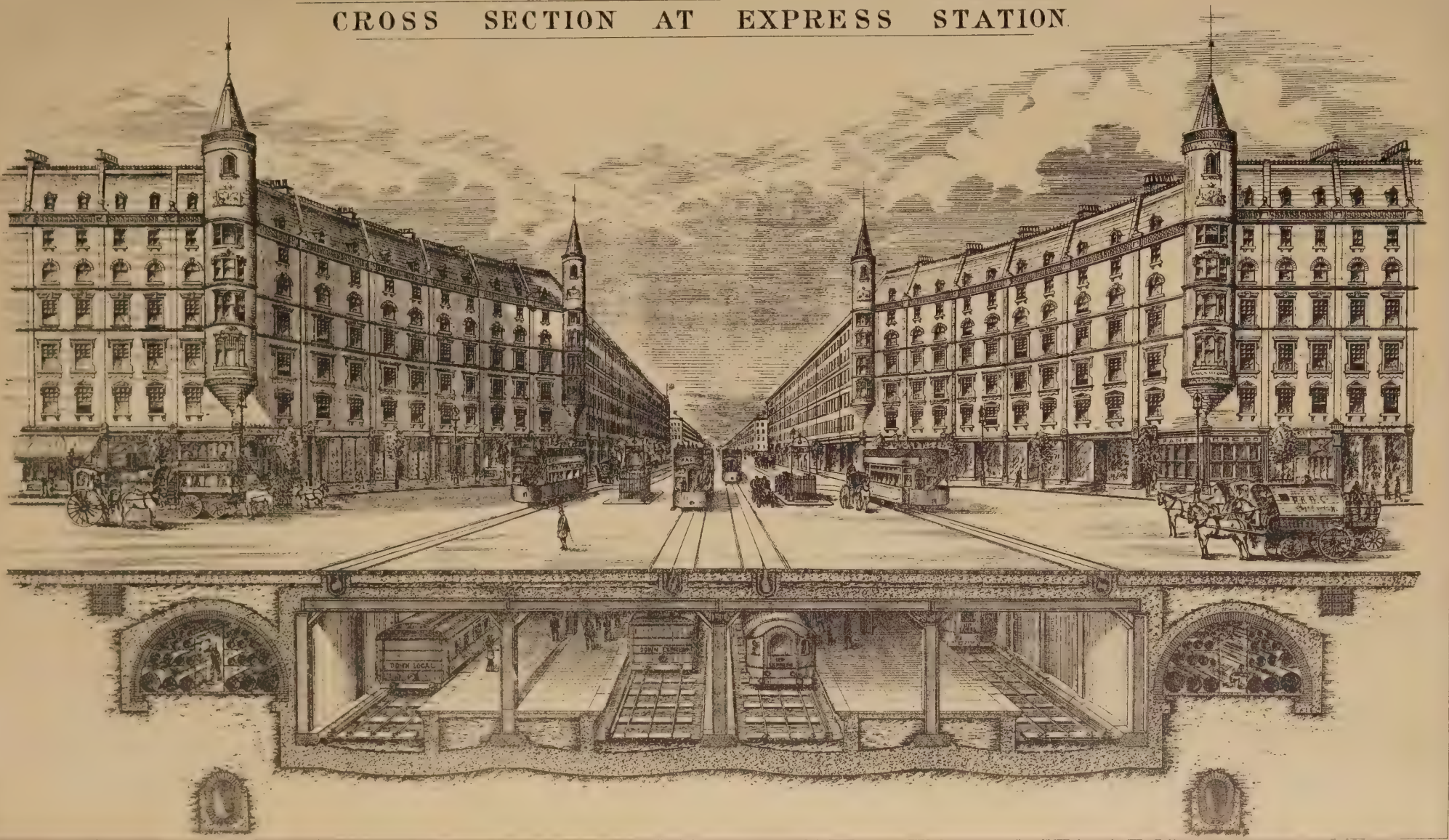
Specific street improvements.

The above are our views as to the mode in which new streets should be made, together with the substructure beneath them; and we now approach the question of the specific street improvements which, in our opinion, are required. In another part of this report particulars are available of the volume of traffic in London (*see* pages 48 to 58), and the delays which occur daily to every class of traveller (*see* pages 58 to 61); showing that for every journey to be undertaken, especially during business hours,

Volume of traffic and delays.

SKETCH SHOWING SUGGESTED MAIN AVENUE.

CROSS SECTION AT EXPRESS STATION.



Weller & Graham, Ltd. Litho London

PLATE No 3.

SKETCH SHOWING SUGGESTED MAIN AVENUE.
CROSS SECTION AT LOCAL STATION.

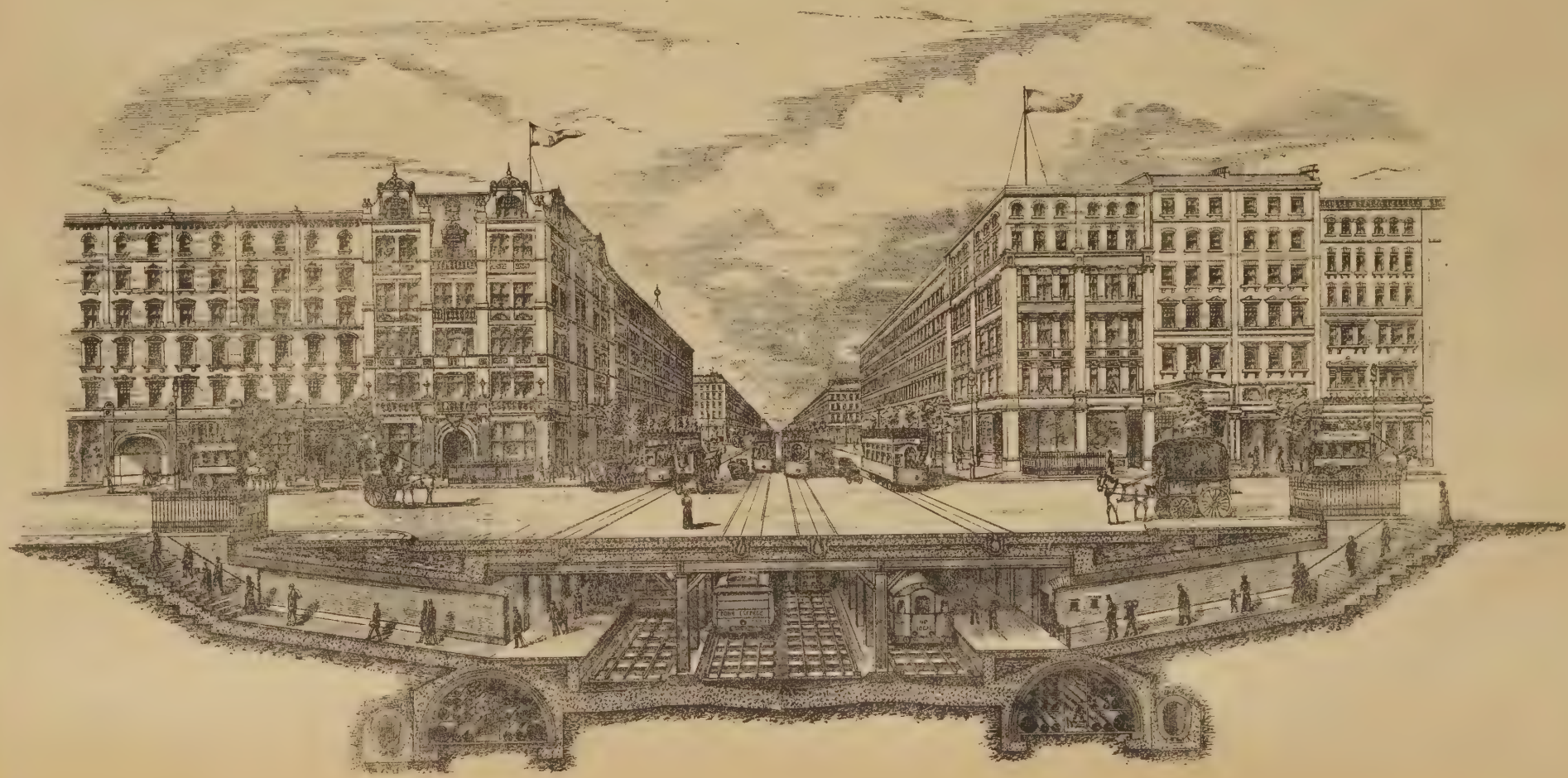


PLATE No 4.

Weller & Graham Ltd Litho London

much more time must be allowed than would be necessary with more adequate streets. The speed of light vehicles in the "Central Area" as has been seen from the Table XVIII. on page 24 falls from eight miles an hour when the streets are fairly free, which might be taken as a fair speed for urban traffic, to about three and a half miles an hour when traffic is at the maximum. During business hours the delays which occur in reaching the suburbs by railway are largely owing to the attempt to combine a system of urban inter-communication served by frequent stations with a system of communication with the outer districts. We shall also see that the present system of concentration of suburban traffic at the principal railway termini, whether in the City or at the ends of the "tube" railways as compared with a system of through trains passing through London collecting or dropping their loads at well-selected spots without any reversal of trains, involves not only the necessity of vast terminal stations, many of which are already too small, but also the congestion of the streets round about them, and entails inconvenience to the passengers, who would naturally prefer to select, among three or four well-placed roadside stations in London, that which is nearest to their destination.

Table XVIII.

Speed of light vehicles.

Cause of delays on railways.

Concentration of traffic at terminal station compared with advantage of through running.

These being some of the salient points of the problem, we are persuaded that, to make a radical cure not only for the present lack of facilities of rapid transit in the two main directions across the Metropolis and into the City, but also for the present difficulty of rapid and convenient communication in all directions with the suburbs, any satisfactory plan must include:—(1) A "Main Avenue" from east to west through London, from Whitechapel to the Bayswater Road; (2) A "Main Avenue" from north to south from Holloway to the "Elephant and Castle," and possibly further south passing by a new bridge across the Thames near to the western boundary of the City; (3) The widening in places to the width of "First" or "Second-class Streets," or the making of new streets of those dimensions, on several of the trunk lines of thoroughfare, not only for the purposes of the existing vehicular and pedestrian traffic, but also in order to facilitate the introduction of tramways—a subject which is discussed at length under another head in this report; (4) Provision to the effect that no new streets for local purposes should be less in width than the width of "Third" and "Fourth-class Streets"; (5) The freeing of points of congestion where the tide of east and west traffic clashes with that from north to south.

Salient requirements.

Dealing in order with these heads, we think that the first named two "Main Avenues" (which we hereinafter refer to as the "Main Avenues"), with their surface and substructure occupied as has been indicated, would be of the greatest value in creating main arteries along which could flow the traffic crossing London or entering it from the suburbs. In addition, however, there are undoubtedly many subsidiary streets the construction of which should be undertaken, while, from the point of view of an adequate service of tramways for the whole of the Metropolis, "Avenues" and "First" and "Second-class Streets" are all true necessities.

Two "Main Avenues."

Subsidiary streets. "Avenues" and "First" and "Second-class Streets" necessary in order to get an adequate service of tramways.

We will first turn to the consideration of the two "Main Avenues."

There is no doubt that, owing to various circumstances, the most important traffic, both local and through, to be facilitated is that to and from the east and west. For this purpose we consider that the project brought before the Royal Commission by Mr. Brereton, and Messrs. Meik and Beer following the general line indicated in a paper read before the Society of Arts in 1898 presents great advantages.

Plan No. 8.

Mr. Brereton's plan is indicated roughly on Plan No. 8, attached to page 69 of this report, and is marked with the letter "A," but we desire to guard ourselves from laying down the location with any precision. The route may no doubt have to be varied in definitive plans, but we content ourselves by saying that it should be slightly to the north of Oxford Street and pass near Liverpool Street to Whitechapel, thus uniting the Bayswater Road at the west with the Whitechapel Road at the east, and giving direct access to and through the City. The tramways on it should be directly connected with the tramways of the London United Tramways Company at Shepherd's Bush and with the London County Council Tramways and the tramways in Essex at its eastern end. From these points ramifications of the tramway system should be made in various directions, and, as the "Main

East and west "Main Avenue."

Tramway connections.

Avenue" would have four lines of tramways upon it, connection or interchange could be made with the various systems crossed in its route, which either have already been made or which may hereafter be developed, such, for example, as those described in the part of this report more specially devoted to the general consideration of routes for tramways for the whole Metropolis.

Railway connections.

The four lines of electrical railway in the substructure of the "Main Avenue" should be connected at either end with the various systems of the existing railway companies, and arrangements should be made for the through running of frequent trains in both directions between points in the suburbs at which trains can conveniently begin and end their journeys.

Cost.

The first cost of such a project would no doubt be great; but if back land be bought with judgment, and some principle of "betterment" were adopted where the side of some present narrow street of small value would become the frontage line of the new "Main Avenue," there would be some "recoupment," such for example as is estimated to occur in Kingsway,[1] and such as has been realised in the Holborn Viaduct[2] undertaking. Owing also to the height to which new buildings in such an avenue might be carried the value of the sites bordering thereon would be very great.

"Recoupment."

We recognise that in important parts of the route there would be no advantage gained by purchasing more land than is absolutely required; but this view does not apply to other parts where cheap property adjoins the site of the proposed "Main Avenues."

"Betterment."

In the east and west "Main Avenues" the question of "betterment" will, it is thought, prove to be of more importance than that of "recoupment" by the sale of surplus lands.

Mr. Brereton's estimate for works.

Mr. Brereton's estimate for surface and substructure works, including the cost of the railways and tramways, amounts to £1,250,000 per mile, or a total of £6,250,000 for the works of the proposed east and west "Main Avenue." The cost of the land has been approximately estimated by Mr. Stenning, the well-known land surveyor, at £11,300,000, to be reduced by "recoupment" to £9,300,000. On the basis of these estimates the total net cost of the "Main Avenue" would work out at £15,550,000 or £3,110,000 per mile. This is a very considerable sum, but Mr. Stenning admitted that the "betterment" had not been thoroughly considered.

Mr. Stenning's estimate for land.

Mr. Andrew Young's estimate for land

Mr. Andrew Young, the valuer to the London County Council, has kindly furnished us with an estimate, which he says is necessarily approximate, of the cost of the land for the new street as shown on Mr. Brereton's plans, and he thinks that the gross cost would be about £17,000,000, but if its execution were deferred for any lengthened period, and it were spread over a term of years, which might probably be the case, this estimate would have to be increased, probably in the latter case to £20,000,000. He considers, however, that modifications might be suggested in the alignment of the new street which would reduce its cost. He thinks that owing to the nature of the property to be acquired the amount of "recoupment" from the sale of surplus land would not be very large, but on the other hand that, if a less cumbrous scheme for the imposition of a "betterment" charge were sanctioned by Parliament, the return from this source might be made considerable, but he has not been able to form any estimate of the probable "recoupment" under this head.

Plates CIII. a & Vol. VI.

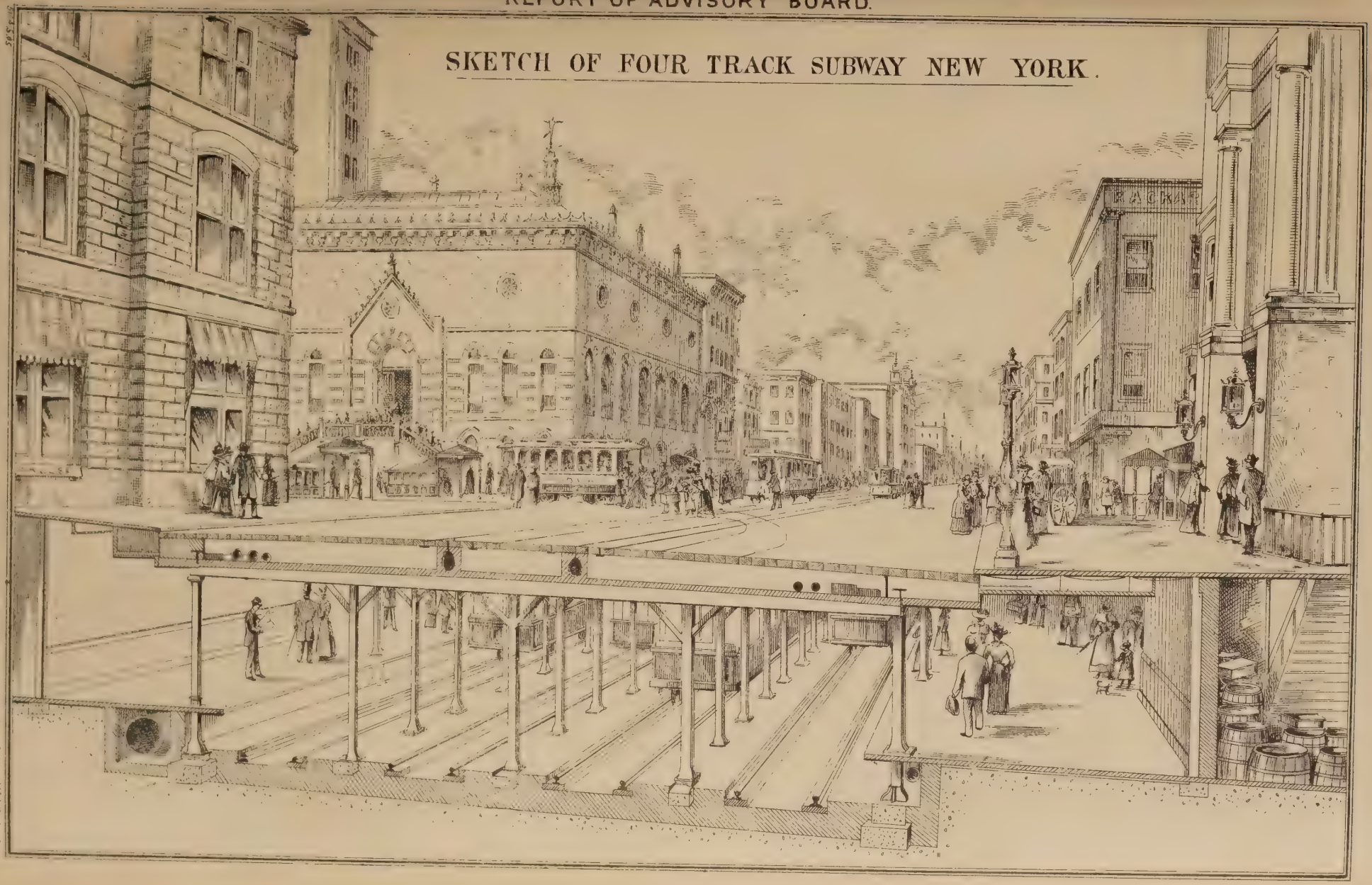
Mr. Ralph Low's estimate for land in connection with Messrs. Meik and Beer's project.

Mr. W. Ralph Low has also submitted an estimate of the cost of property, and the amount of "recoupment" in connection with the proposal submitted to the Royal Commission by Messrs. Meik and Beer for the construction of somewhat similar "Main Avenues" through London from north to south, and east to west. Mr. Low takes a more favourable view of their probable net cost than Mr. Andrew Young, but Mr. Low contemplates the employment of a very large amount of capital, and his estimated return would not be realised for a number of years. He bears out our preceding remark that, under a well considered scheme, the amount of

---

[1] Q. 4251 Expenditure £4,800,000, recoupment £4,000,000.
[2] Q. 14769 Gross cost £2,522,406. Q. 14772 Net cost £1,571,000.

SKETCH OF FOUR TRACK SUBWAY NEW YORK.



Waller & Graham Ltd Lithos London

"betterment" and "recoupment" might be substantial. It is evident, however, that it is impossible to arrive at any very trustworthy figures in the absence of careful alignment and detailed surveys and estimates of all the individual properties required.

"Recoupment" from tramways and railways.

There are two other considerations, apart from the sale of back land and ground rents or "betterment," which should be regarded as "recoupments" of the first cost. These are the tramways, which would enable London, for the first time, to have a really adequate tramway and railway service in the two chief directions into the City, with ramifications at each end in all directions.

Value of tramway connections east and west.

It is difficult to assess the value of these facilities. They would, we think, be of the greatest convenience, while, without a new wide street, a through service of surface tramcars east and west and north and south through the City is, with its narrow streets, impracticable. In fact, speaking generally, proper tramway facilities cannot be given along any main routes in London without extensive widenings or new streets or except by "shallow" subways such as that being made in Kingsway. Through tramways in the two "Main Avenues" would add greatly to the returns of the tramway systems in existence at the west and east of London, and the intrinsic value of such a wayleave would be very large, apart altogether from the benefits to the public, using the tramways, in economy of time and consequent saving of money.

Value of railway under "Main Avenues."

The same remarks apply, with at least equal force, to the four lines of electrical railway. The prices which have been paid by railway companies such as the Metropolitan, Metropolitan District, and the various "tube" railway companies for a double line of rails through urban London have approximated to a capital of £800,000 per mile including equipment, as shown in the railway section of this report, and, for four lines of railway track, the value might be taken at nearly twice as much. If the tramways and railways, which would be rendered possible by the construction of the "Main Avenues," and which would, in the case of the east and west "Main Avenue," be $4\frac{3}{4}$ miles in length, were built upon strictly cash principles by the London County Council, and leased to the various companies engaged in the operation of the two modes of locomotion, there would appear to us to be no doubt that a "recoupment" on a large scale would be the result.

Expenditure should be faced.

Formidable therefore as the figures of first cost of the "Main Avenues" may seem, they appear to us to be such as should be faced in view of the advantages to be gained.

Reasons for not recommending widening of Oxford Street and Holborn Viaduct.

It may be asked, would it not be preferable to widen the existing main route of Oxford Street and Holborn, rather than make a new "Main Avenue?" The reasons against the widening of such a thoroughfare are that the disturbance of very expensive properties and trades would probably make the widening more costly, while, as a result, only one street would be provided instead of two; also that there could be no "recoupment" from the development of less expensive property into valuable frontage land and no "betterment," and that the Oxford Street route already possesses a "tube" railway. In addition to these considerations the Holborn Viaduct would present almost insuperable difficulties, either in relation to widening or the construction of through routes of railways immediately beneath the street level. Oxford Street and High Holborn are very irregular streets, wide in some places, narrow in others, and they are, and will always form a great line for traffic. The widening, however, of a few narrow places would give much relief and might be well worth undertaking.

Difficulty of widening east of Holborn Viaduct.

East of the Holborn Viaduct, if Oxford Street and Holborn are to be widened and become a "Main Avenue," there could be only two alternatives, either to prolong the "Main Avenue" in a direct line to Whitechapel by widening Newgate Street, Cheapside, and Leadenhall Street to a width of 140 feet, which is quite impracticable on the ground of cost, or else to make a curved avenue from Holborn Circus *via* Liverpool Street or its neighbourhood to Whitechapel. The latter alternative, however, involves the acquisition of the most expensive property comprised in the route suggested by Mr. Brereton. From all points of view, therefore, a completely new avenue seems to be the better plan.

North and south "Main Avenue."

When we come to the other "Main Avenue," north and south, the same considerations apply, though not in some respects with the same force. The volume of traffic in this direction is not so great as that from east to west, and there are no systems of docks to be accommodated, so that the element of goods traffic at night on the railways as a source of revenue would be more or less absent. The general alignment of this "Main Avenue" is shown on Plan No. 8 and is marked with the letter "B." It was brought before the Royal Commission by Mr. Brereton, and by Mr. Fitzmaurice, the engineer of the London County Council, also by Messrs. Meik and Beer and other witnesses. Their proposals do not differ materially, except that both the latter schemes prolong their main avenue to near the Crystal Palace. Apart from being a through route for every description of traffic, this "Main Avenue" would, from a tramway point of view, be without doubt of great value, by uniting the north and south systems of tramways, and bringing them into touch with the City of London. By the railways beneath the "Main Avenue" large tracts of land available for building purposes could brought into use, especially in the north of London, where it is probable, from the lower value of land, artisans' villages could best be established. This point was brought prominently before the Royal Commission by the officers of the London County Council who pointed out suitable districts in the north of London at present undeveloped for want of railway accommodation.

Plan No. 8.

Mr. Brereton's and Mr. Stenning's estimate for north and south "Main Avenue."

Mr. Brereton estimates the first cost of the works and land of the north and south main avenue, as proposed by him, which would have a length of $4\frac{1}{4}$ miles, at £8,550,000, of which £2,550,000 is for works, and £7,000,000 for land, less £1,000,000 "recoupment," on the basis of figures supplied by Mr. Stenning.

Mr. Fitzmaurice's recommendations.

In connection with the proposal for a main avenue from the Strand to the boundary of the County of London, near the Crystal Palace, Mr. Fitzmaurice recommends very nearly the same route as far as the point to which Mr. Brereton's scheme extends, and estimates the cost of works at £640,000 per mile, which agrees closely with Mr. Brereton's figure.

Mr. Young's estimate.

The land and property estimates for this proposal were made by Mr. Andrew Young, valuer to the London County Council. Mr. Young's figures cannot be directly compared with Mr. Stenning's, as the greater part of the route to which they refer is through much less proportionately expensive property, but it is important to note that Mr. Young considers that, by purchasing enough surplus land in the first instance, the cost of that required for the construction of a new street can be largely, if not wholly, "recouped."

Mr. Low's figures, worked out on a similar basis, show that the "recoupment" would cover the first cost of the land and property, even allowing for interest on the capital employed, so that the ultimate cost of the "Main Avenue" would be the amount of the expenditure on works alone. As already pointed out, Mr. Low supposed the employment of very large capital sums, with "recoupment" over a long period of years, while he also attaches importance to the concurrent construction of both north and south and east and west "Main Avenues."

Bridge over Thames and over the Strand.

The "Main Avenue" north and south would be, as we have said, carried over the Thames, and the bridge would be at such a height as to pass the new road over the Strand. It would be made to cross the east and west "Main Avenue" by a bridge over or under it, as may be found the more convenient, and junction roads would connect the north and south "Main Avenue" with the east and west "Main Avenue."

Other suggestions for new and widened streets.

Leaving the question of the two "Main Avenues," the streets to which shall now refer are those which appear to us to require immediate attention; but we must observe that in the vast area of London it is quite impossible to attempt to make an exhaustive list of all requirements, or to deal with each of the suggestions as to new streets which were brought before the Royal Commission. We may refer in this connection to the evidence of: Mr. Maurice Fitzmaurice, C.M.G., M.Inst.C.E.; Mr. W. E. Riley, F.R.I.B.A., M.Inst.C.E.; Mr. J. H. Robinson, Alderman of Stepney Borough and Chairman of the Works Committee; Mr. J. Rush Dixon,

Assoc.M.Inst.C.E., Surveyor of Southwark; Mr. W. Rees Jeffreys, Hon. Sec. Automobile Club; Mr. R. W. Perks, M.P.; Mr. J. Douglass Mathews, Surveyor, Member of the Corporation of the City of London; Sir J. Whittaker Ellis, Bart., Ex-Lord Mayor of London; and Sir Henry Edmund Knight, Alderman of the City of London; and others.

The smaller schemes should be carried out while preparing for the larger.

It is proper that we should point out that the "Main Avenues" and the smaller new or widened old streets, as hereafter described, stand on different footings. The former are large schemes requiring much thought to plan and carry out properly. The latter are simpler in conception, and less costly in construction. While the first are being considered, the others can readily be taken up, put into effect, and afford much needed immediate relief.

Widening of the Euston and Marylebone Roads.

lan No. 8.

The first of these improvements to which we will allude is the case of the Euston and Marylebone Roads, marked "C" on Plan No. 8. These form a highly important thoroughfare, and might, at no very considerable expense, be made into a continuous street of the first class. They are already fairly wide, but in places are much contracted, as will be seen from the precise widths as given below. For a considerable part of the route the roads are bordered by forecourts or gardens; but, unfortunately, in many cases these have been built over and one-story shops erected thereon. At other places, though only for a short length, three or four-storied houses contract the thoroughfare to 48 feet from house to house.

Act of George II.

New powers required.

An Act of Parliament of George II., in the year 1756, enacted that no buildings should be erected within 50 feet of the sides of the Pentonville, Euston and Marylebone Roads, which roads were to be of the width of 60 feet; but from some cause this well-conceived Act of Parliament has been repealed or allowed to fall into abeyance. We would urge that the principle on which the Act was based by Parliament should now be acted on, and that, where necessary, the adjoining properties should be acquired under renewed powers. We also think that, as a provision for the future, no further building on the forecourts or gardens within 50 feet of the centre line should be permitted. We assume, of course, that proper compensation would be given for interference with such private rights as may exist.

iagram o. 4.

At Tottenham Court Road and opposite the great railway stations of St. Pancras and King's Cross, immediate widening would seem to be especially desirable. Below we give Table XXIV. in which is shown: (1) The existing width of Euston and Marylebone Roads between the boundaries of private property; (2) The length where forecourts or gardens exist; (3) The length occupied by one-storied buildings; (4) The length occupied by houses of more than one-story; while facing page 40 the net area of the land required for widening the Euston and Marylebone Roads to 100 feet, and the nature of the property required are illustrated by Diagram No. 4.

Table XXIV.

EUSTON AND MARYLEBONE ROADS, FROM KING'S CROSS TO STAFFORD STREET.

Total length:—10,560 feet, or 2 miles.

(1) Length where the width between boundaries of private property is:—

Over 100 feet.	80 feet to 100 feet.	60 feet to 80 feet.	40 feet to 60 feet.	Under 40 feet.
420 feet.	120 feet.	4,470 feet.	5,550 feet.	—

Length bordered by :—

(2) Gardens or enclosed Forecourts.		(3.) Buildings one-story high.		(4.) Buildings more than one-story high.	
On the North side.	On the South side.	On the North side.	On the South side.	On the North side.	On the South side.
Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
6,124	6,578	* 1,296	1,441	† 1,707	971

* Including 276 feet St. Pancras Goods Station.
† Including 496 feet St. Pancras Station and Hotel.

New street from the Marylebone Road to Edgware Road facing Harrow Road.

West of Stafford Street, instead of continuing the widening of the Marylebone Road, we would recommend that a new "First-class Arterial Street," marked "D" on Plan No. 8, be cut through to the Edgware Road facing the Harrow Road. The property necessary for this new street is of a poor class, and the net amount required for the street would be 87,000 square feet. Plan No. 8

Plan of the Euston and Marylebone Roads.

Facing page 84 of this report we give Plan No. 19 showing exactly the present condition of the Euston and Marylebone Roads. Plan No. 19

Sir Henry Knight's road from the Edgware Road to Farringdon Road.

The next suggested thoroughfare, as being in the same neighbourhood, to which we would draw attention, is that described in the evidence[1] of Sir Henry Knight, who points out that, by utilising existing streets and by the formation of short lengths of new streets, a continuous street of what we have denominated a "Third-class Street" could be made from the Edgware Road continuously to the Farringdon Road. No doubt such a thoroughfare, which would be 2½ miles in length, would give considerable relief to the crowded neighbourhood through which it would pass, although it must be seen, from what we have said above as to the width required for such a main arterial line of communication, that it would not fulfil the purpose. The details of Sir Henry Knight's project, which would act as a relief street to Oxford Street, and which, no doubt, could be made at a comparatively small cost, are as follows :—

Details of Sir Henry Knight's road.

Commencing at the Edgware Road the proposed thoroughfare follows Upper George Street (46 ft. wide) and George Street across Baker Street as far as Thayer Street (57 ft. wide). From Thayer Street the route taken is almost due east by means of an entirely new street (75 ft. wide) across Portland Place and Great Portland Street to the Tottenham Court Road at a point opposite Chenies Street. Traversing Chenies Street (46 ft. wide) to Gower Street, it is carried by means of a new street (75 ft. wide) to the north side of Russell Square, which it crosses, turning along the east side of the square to Guilford Street (46 ft. wide), the whole length of which is followed to the Gray's Inn Road, where it bends to the south-east and, again by means of a short length of new street (75 ft. wide), passes across Rosebery Avenue to a junction with Farringdon Road, immediately north of Clerkenwell Road, where it terminates.

Sir Henry Knight's road local in character.

Sir Henry Knight's proposal for the length between his termini is on much the same line as the "Main Avenue" which we have recommended, but it is too local in its character and too small in its dimensions to be considered as an alternative to the larger proposal. In our opinion the suggestion may be looked on as supporting, so far as it goes, the idea of the necessity for an east and west "Main Avenue."

New road from The Mall to Charing Cross.

A very important improvement which has been long promised is the connection of the great processional road—The Mall—through Spring Gardens into Charing Cross, marked "E" on Plan No. 8. Only a very small amount of property intervenes between the processional road and the western end of Northumberland Avenue, and the project forms part of the great scheme of the Memorial to Her late Majesty Queen Victoria. We are persuaded that this road will afford great relief to Cockspur Street, the lower end of Regent Street, Pall Mall, St. James's Street and Piccadilly, as traffic for Hyde Park Corner and all points west of Hyde Park Corner could Plan No. 8

---

[1] Sir Henry Knight, Q. 14511, Vol. II.

ROYAL COMMISSION ON LONDON TRAFFIC.
REPORT OF ADVISORY BOARD.

WIDENING EUSTON AND MARYLEBONE ROADS TO A WIDTH OF 100 FEET FROM KING'S CROSS TO STAFFORD STREET.

DIAGRAM OF AREAS.

Total Area	374,422	square	feet.
Gardens	226,256	"	"
Open spaces	10,683	"	"
Yards	23,803	"	"
Church Yards	14,473	"	"
One story buildings	47,431	"	"
Buildings more than one story	45,162	"	"
Public Houses	6,614	"	"

Note. In all cases the areas given are the net areas required exclusive of any surplus land.

Waller & Graham, Ltd Litho. London

pass by Constitution Hill and free the present crowded route *via* Piccadilly. It would also form the access to Buckingham Palace Road and Victoria Station, and so be a relief, not only to Pall Mall, but also to Parliament Street and Victoria Street.

Plan No. 8. Constitution Hill, marked "F" on Plan No. 8, page 62, should no doubt be widened and made a more worthy approach to Buckingham Palace as well as a route for traffic such as has been provided by the processional road. This improvement could be carried out by taking a narrow strip from the Green Park, and need not interfere with its amenity. Widening of Constitution Hill.

Plan No. 8. Another road to which we attach importance is one advocated by the officials of the City of Westminster, marked "G" on Plan No. 8. They recommend that Princes Street, Westminster, which is at present a narrow and tortuous street between Victoria Street and Great George Street, in which much of the property is either vacant or about to be pulled down, should be made a wide thoroughfare, and passing by Storey's Gate should join the existing road in St. James' Park, and be carried into Waterloo Place by an inclined road passing on each side of the Duke of York's Column. This improvement was also recommended by Sir John Whittaker Ellis, Bart., in his evidence[1] before the Royal Commission. The contemplated Government office which is to be built on the northern side of Great George Street should have its south-west angle kept backward to align with this road, and this could easily be done. It might also be desirable that Storey's Gate should be removed altogether or be shifted slightly to the west, to either of which suggestions there would appear to be no objection. The new frontage for Princes Street should be settled upon in view of this proposal, before the Aquarium site has been again covered with buildings. At first sight it might appear that the gradient of the road at the Duke of York's Column would present difficulties, but this is not a fact, as the southern end of Waterloo Place rises sharply towards the park, and the levels could be so adjusted as to be unobjectionable. This road to which we have just drawn attention would be a considerable relief to the neighbourhood of the Houses of Parliament, and also to Parliament Street, Charing Cross, and Trafalgar Square. Widening of Princes Street, Westminster, and new road, thence to Waterloo Place.

Plan No. 8. In this connection, or indeed, in any case, it would be advisable to widen the Broad Sanctuary, Westminster, marked "H" on Plan No. 8, opposite to the Middlesex Guildhall and the Westminster Hospital, as the traffic at this spot is much congested at the present time. This improvement could easily be carried out by setting back the railings of St. Margaret's Churchyard, and making the existing line of trees the front of the new footway. Widening of Broad Sanctuary, Westminster.

Plan No. 8. Plans Nos. 15, 10, 11, 18. Four very important main lines of streets giving access to the west and south next claim our attention. These are the Bayswater Road, the Kensington Road, the Fulham and Brompton Roads, and the King's Road, Chelsea, marked "I," "J," "K," and "L" respectively on Plan No. 8. Plans of these roads, Nos. 15, 10, 11, and 18, will be found facing pages 82, 80, 80, and 82 respectively of this report. Widening of Bayswater Road, Kensington Road, Fulham and Brompton Roads, and King's Road, Chelsea.

They are of special importance in connection with the future prospects of tramway accommodation, and in the general interests of London they ought, no doubt, to be "First-class Arterial Streets," and, as explained elsewhere, to be tramway routes.

Their present ordinary vehicular traffic is very heavy, and on all of them there is an important number of omnibuses which it may be anticipated will be almost, if not absolutely, removed from them by an efficient tramway service. Apart, however, from omnibuses, there is a large and growing traffic of other vehicles, including, in a marked degree, that of motors. Present traffic on these four roads.

---

[1] Sir John Whittaker Ellis, Bart., Q. 23922, Vol. II

Schedule of traffic on these four roads.

The following is a schedule of the traffic of the four roads under consideration :—

TABLE XXV.

VEHICULAR TRAFFIC ON ROADS "I," "J," "K," AND "L."

(*See* Plan No. 8, page 69).

Plan No. 8

THOROUGHFARE.	NUMBER OF VEHICLES OF ALL CLASSES.					
	Between 8 a.m. and 8 p.m.			During "Busiest Hour."		
	East-bound.	West-bound.	Total.	East-bound.	West-bound.	Total.
("I") Bayswater Road (west of Edgware Road) - - -	5,560	6,256	11,816	514	718	1,232
("J") Hammersmith Road (at the Broadway) - - -	2,826	3,453	6,279	227	351	578
("K") Fulham Road (at Cancer Hospital) - - - - -	2,625	2,761	5,386	257	305	533
("L") King's Road (west of Sloane Square) - - -	2,351	2,336	4,687	231	260	488

Width recommended and existing widths

There can be no doubt that, as we have said, each of these roads should have the width of "First-class Arterial Streets," viz., 100 ft., but the following dimensions will show how far short they are of such dimensions, and it is a matter of common knowledge that in places they are much congested.

TABLE XXVI.

WIDTHS OF ROADS "I", "J", "K", AND "L."

(*See* Plan No. 8, page 69).

Plan No. 8

THOROUGHFARE.	ROAD WIDTHS.					
	Total over footpaths.			Carriage-way only.		
	Maximum.	Minimum.	Mostly.	Maximum.	Minimum.	Mostly.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
("I") Bayswater Road - -	89 0	59 0	64 0	56 0	39 0	44 0
("J") Kensington Road - -	76 0	47 0	59 0	52 0	31 0	39 0
("K") Fulham and Brompton Roads.	70 0	33 6	50 0	46 9 to 45 0 for 300 ft.	21 1 to 25 0 for 600 ft.	33 2
("L") King's Road, Chelsea -	61 0	34 0	51 0	37 8 for 200 ft.	19 10 to 23 6 for 300 ft.	29 7

Nature and extent of property required to widen those four roads to 100 feet.

In the case of the four roads above mentioned similar information as that for the Euston and Marylebone Roads is given facing pages 42, 44, 46 and 48, on Diagrams Nos. 4A, 4B, 4C, and 4D.

Diagrams Nos. 4A, 4C, 4D.

ROYAL COMMISSION ON LONDON TRAFFIC.
REPORT OF ADVISORY BOARD.

WIDENING BAYSWATER ROAD TO A WIDTH OF 100 FEET FROM UXBRIDGE ROAD STATION TO EDGWARE ROAD.

DIAGRAM OF AREAS.

Total Area	341,919	square feet
Park	174,312	" "
Building land	5,247	" "
Gardens	96,876	" "
Yards	3,087	" "
Areas	1,197	" "
One story buildings	7,101	" "
Buildings more than one story	48,285	" "
Public Houses	5,814	" "

NOTE. In all cases the areas given are the net areas required exclusive of any surplus land.

Weller & Graham, Ltd Litho. London.

Table XXVII.

BAYSWATER ROAD, FROM UXBRIDGE ROAD STATION TO EDGWARE ROAD.

Total length :—13,260 feet, or 2 miles 40·9 chains.

(1) Length where the width between boundaries of private property is :—

Over 100 feet.	80 feet to 100 feet.	60 feet to 80 feet.	40 feet to 60 feet.	Under 40 feet.
360 feet.	2,075 feet.	9,255 feet.	1,570 feet.	—

Length bordered by :—

(2) Gardens or enclosed Forecourts.		(3) Buildings one-story high.		(4) Buildings more than one-story high.	
On the North side.	On the South side.	On the North side.	On the South side.	On the North side.	On the South side.
Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
4,685	10,613	1,862	206	4,569	1,471

Table XXVIII.

KENSINGTON ROAD, FROM HAMMERSMITH BROADWAY TO KNIGHTSBRIDGE.

Total length :—15,150 feet, or 2 miles 69·54 chains.

(1) Length where the width between boundaries of private property is :—

Over 100 feet.	80 feet to 100 feet.	60 feet to 80 feet.	40 feet to 60 feet.	Under 40 feet.
—	140 feet.	8,305 feet.	6,705 feet.	

Length bordered by :—

(2) Gardens or enclosed Forecourts.		(3) Buildings one-story high.		(4) Buildings more than one-story high.	
On the North side.	On the South side.	On the North side.	On the South side.	On the North side.	On the South side.
Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
10,091	5,794	590	1,444	2,802	6,223

Table XXIX.

FULHAM AND BROMPTON ROADS, FROM FULHAM PALACE ROAD TO KNIGHTSBRIDGE.

Total length :—16,700 feet, or 3 miles 13 chains.

(1) Length where the width between boundaries of private property is :—

Over 100 feet.	80 feet to 100 feet.	60 feet to 80 feet.	40 feet to 60 feet.	Under 40 feet.
280 feet.	840 feet.	2,875 feet.	12,565 feet.	140 feet.

Length bordered by :—

(2) Gardens or enclosed Forecourts.		(3) Buildings one-story high.		(4) Buildings more than one-story high.	
On the North side.	On the South side.	On the North side.	On the South side.	On the North side.	On the South side.
Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
5,769	4,331	332	1,317	7,576	8,682

Table XXX.

KING'S ROAD, CHELSEA, FROM FULHAM HIGH STREET TO SLOANE SQUARE.

Total length :—14,700 feet, or 2 miles 62·72 chains.

(1) Length where the width between boundaries of private property is :—

Over 100 feet.	80 feet to 100 feet.	60 feet to 80 feet.	40 feet to 60 feet.	Under 40 feet.
—	—	4,020 feet.	9,980 feet.	700 feet.

Length bordered by :—

(2) Gardens or enclosed Forecourts.		(3) Buildings one-story high.		(4) Buildings more than one-story high.	
On the North side.	On the South side.	On the North side.	On the South side.	On the North side.	On the South side.
Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
5,904	5,382	747	720	5,960	6,667

WIDENING KENSINGTON ROAD TO A WIDTH OF 100 FEET FROM HAMMERSMITH BROADWAY TO KNIGHTSBRIDGE

DIAGRAM OF AREAS

Total Area	428,085	square	feet.
Park	74,159	"	"
Building land	855	"	"
Gardens	175,859	"	"
Churchyard	2,277	"	"
Areas	11,170	"	"
One story buildings	27,284	"	"
Buildings more than one story	126,158	"	"
Public Houses	10323	"	"

NOTE. In all cases the areas given are the net areas required exclusive of any surplus land.

Weller & Graham, Ltd Litho. London

It will be seen that, as in the Euston and Marylebone Roads, considerable portions of these roads, which need widening, are lined by forecourts or gardens, and it seems obvious that some immediate and well-considered scheme of improvement should be set on foot. Owing to the rapid increase of western and south-western London the four roads in question have become of great importance, and there is an obviously unanswerable demand for tramways. The character of the traffic is shown by the following table :—

Immediate steps required to prevent building on forecourts and gardens.

Demand for tramways from south-western and western London to "Central Area."

TABLE XXXI.

CHARACTER OF TRAFFIC ON ROADS "I," "J," "H," AND "L."

Plan No. 8. (*See* Plan No. 8, page 69.)

Character of traffic on roads "I," "J," "K," and "L."

THOROUGHFARE.	Number of Omnibuses per day. 8 a.m.—8 p.m.	Number of other Vehicles per day. 8 a.m.—8 p.m.	Percentage of Number of Omnibuses to Total Number of Vehicles of all Classes.
("I.") Bayswater Road (west of Edgware Road) - - - - - -	704	11,112	6%
("J.") Hammersmith Road (at The Broadway) - - - - - - -	1,472	4,807	23%
("K.") Fulham Road (at Cancer Hospital)	1,362	4,024	25%
("L.") King's Road (west of Sloane Square)	1,399	3,288	30

We cannot think that tramways, with a service of tramcars which would in the future be more numerous than the present omnibuses, could be properly laid on these roads, where there is less width than that sufficient for a standing vehicle and one row of moving vehicular traffic on each side of the tramways. This would involve 48 feet between the kerbs, or 80 feet between the boundaries of private property. We should look even on the width of 80 feet as but a temporary expedient, and consider that 100 feet should be eventually afforded for such trunk roads.

Widths should be that for "First-class Arterial Streets."

What, then, should be done? If tramways are a necessity, as to which we are agreed, the proper plan is at once to widen these roads, and wherever widening has to be done, to adopt a width of preferably 100 feet. As an alternative it has been proposed to make a "tube" railway or "shallow" subway in these roads, but either of these would be very costly, and much less efficient than an adequate widening of the roads themselves.

Widening roadways more efficient than tramway subways in these cases.

It may, no doubt, be possible, in respect of short lengths of the thoroughfares, and as a temporary measure, to lay the tramways when the road itself is less than 48 feet, in accordance with the standard of the London County Council, which aims at a minimum of 33 feet between the kerbs, but we are persuaded that it will be an unsatisfactory expedient barely tolerable for a few years, and would gravely detract not only from the convenience of the road, but be also detrimental to the general value of property, including that fronting on the rest of the road. These roads are an additional example of how closely street improvements are associated with any possible improvement of mechanical means of transit, and how the neglect of former generations has contributed to the difficulties of the present time.

Tramways on 33 feet roadways undesirable in the case of trunk roads.

Some places in the King's Road are almost grotesque in mal-arrangement; for instance, sharp and inconvenient curves are noticeable at its east end and west end, while at one spot there is a double right-angled bend in 60 yards where the street is only 23 to 30 feet wide between kerbs, and at this very spot the sides of the road are often occupied by rows of stationary costermongers' barrows.

Mal-arrangement of King's Road, Chelsea.

A great improvement could be made by extending Cromwell Road towards the west, marked "M" on Plan No. 8, page 69, and several proposals have been unsuccessfully made for this purpose. Unfortunately a slight amount of opposition and want of public support has stood in the way of this really valuable proposal, which might, by suitable junctions and extensions, materially

Plan No. 8.

Extension of Cromwell Road.

lessen the present difficulties at the eastern end of the Fulham and Brompton Roads.

King's Road, Fulham and Brompton Roads, and Fulham High Street.

The remarks which have been made on the King's Road apply *mutatis mutandis* to the Fulham and Brompton Roads, and it is unnecessary to refer to the latter in detail. It is to be observed that both roads debouch on Putney Bridge, having previously to pass through the narrow High Street of Fulham. Widenings or alternative streets are required in both instances.

Width of Putney Bridge inadequate.

Putney Bridge, which was erected scarcely 18 years ago, only 44 feet wide between parapets and 25 feet wide between kerbs, is already too narrow for its traffic, while it ought soon to have a tramway service over it. The inadequate width of Putney Bridge is another example of the great necessity for a more continuous and comprehensive grasp than heretofore of the requirements of the traffic of London.

Hammersmith Road.

The Hammersmith Road, speaking generally, is conceived on somewhat larger ideas than the King's Road or Fulham and Brompton Roads, but it is, in places, lamentably narrow. Quite recently at Kensington new buildings of importance have been permitted to be built within 34 feet of the centre line of the road, and even the local authority has erected a Town Hall the front of which is only 26 feet from the centre of the roadway. Again both eastward and westward of Hammersmith Broadway the roadway is much too narrow, and in the main street of Hammersmith, immediately

Hammersmith Broadway and King Street, Hammersmith.

west of the Broadway, marked "N" on Plan No. 8, the street for a length of about half a mile is only 27 to 33 feet wide between kerbs, the south side of the roadway being occupied by costermongers' barrows. In this constricted roadway a single line of tramway has been laid, and along it about 24 cars per hour have to thread their way. The delays to traffic and disturbance of business here are very serious. Plan No. 8.

Bayswater or Uxbridge Road.

The Bayswater or Uxbridge Road is in a better position than any of the other four roads, but there are several constrictions in it, and this main route from the west ought certainly to be widened gradually throughout to a width of at least 100 feet.

Roads discussed are only instances for immediate improvement.

We have discussed at some length the four main routes to the west and south-west, not as exhausting the subject of main routes in and through the urban parts of London, but as instances for immediate improvement.

Wandsworth Road.

There are other routes of importance; for example, the Wandsworth Road, marked "O" on Plan No. 8, which, with a moderate amount of provision, and at no great cost, might have been made a most useful through route. It carries a large traffic at the present time, but it has been much neglected with regard to widening, and should be improved. Again, what is true of the Wandsworth Road is applicable to almost all the main routes with the exception of some in the east and south-east. Plan No. 8.

All trunk roads require to be dealt with systematically.

Speaking generally, all the trunk roads leading out of central London to the immediate suburbs require now to be dealt with systematically, some of them perhaps forthwith, others in a gradual way; but in all cases a standard should be set, which we think should not be less than 100 feet of width as a minimum.

Old Kent Road, Whitechapel Road, Clapham Road, Brixton Road, City Road, and Edgware Road.

A more adequate knowledge of what is required for main roads leading out of London was shown when the Old Kent Road, the Whitechapel Road in the south-east and east, the Clapham and Brixton Roads in the south-west and south, and in a less degree the City Road and parts of the Edgware Road in the north and north-west were laid out.

TABLE XXXII.

WIDTHS OF OLD KENT ROAD, ETC.

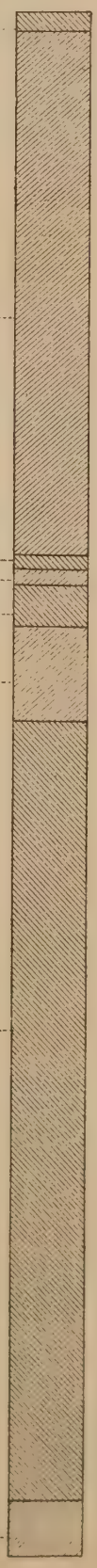
Thoroughfare.	Road Widths.					
	Total over footpaths.			Carriage-way only.		
	Maximum.	Minimum.	Mostly.	Maximum.	Minimum.	Mostly.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Old Kent Road	100 10	55 0	70 0	51 0	33 0	44 0
Whitechapel Road	144 9	66 0	120 0	54 0	40 0	50 0
Clapham Road	100 0	59 0	75 0	58 0	34 0	45 0
Brixton Road	97 0	53 0	63 0	48 0	32 0	42 0
City Road	74 0	52 3	68 0	51 0	34 0	38 0
Edgware Road	92 3	57 6	78 0	48 0	30 0	44 0

ROYAL COMMISSION ON LONDON TRAFFIC.
REPORT OF ADVISORY BOARD.

WIDENING FULHAM & BROMPTON ROADS TO A WIDTH OF 100 FEET FROM FULHAM PALACE ROAD TO KNIGHTSBRIDGE.

DIAGRAM OF AREAS.

Total Area	613,062	square feet
Building land	6,236	" "
Gardens	204,810	" "
Churchyards	5.320	" "
Yards	5.926	" "
Areas	16,184	" "
One story buildings	37,635	" "
Buildings more than one story	316,366	" "
Public Houses	20585	" "



NOTE. In all cases the areas given are the net areas required exclusive of any surplus land.

Weller & Graham Ltd. Litho London.

These thoroughfares were made when roadway traffic was much less than at present, but fortunately they were busy stage coach routes, and allowance for quick traffic was no doubt made. At the present time even these comparatively wide roads are barely equal to modern necessities, and, unfortunately, encroachments have in many instances been made upon them. All such encroachments ought to be stopped, and no building on front gardens or forecourts any longer permitted until a full allowance has been made for future requirements for traffic purposes. Action taken now, looking to the protection of forecourts from further building encroachments, will render easy and economical the future widening of these important streets; for widened we hold they must be as time, opportunity, and finance will permit.

Encroachments should be stopped.

The widenings of streets should not in justice be considered or treated as incidental merely to tramways. They are necessary in all cases as the widening of the Strand is necessary to accommodate street traffic, of which tramways under modern conditions form as much a part as cabs or other vehicles. When the great cost of subways for tramways, which is the only alternative to widening the streets for tramway purposes, is considered, it will, we think, be found, that, except in localities where property is specially valuable, street widening for surface tramways will be the less costly process, while it is evident that there are very many concurrent advantages in the latter as compared with the former alternative even if it should prove otherwise.

Widening of streets a necessity not merely for tramways.

Subways.

A subject which has been brought before us in a prominent way is the necessity for at once dealing with the main arterial roadways of, what may be termed, external London, from the places at which the main urban routes leave the town, and after passing through suburbs reach the main (originally turnpike) roads in the country.

Main arterial roadways of external London.

In these cases, also, the problem requires immediate attention, and it appears that very little care is being given to it. The case of Brentford is a conspicuous example of a state of things which urgently calls for regulation and amendment. The road through Brentford is a main route from London to Hounslow, Slough, Windsor, Maidenhead, Reading, and the west of England, but through Brentford the road is only 19 feet wide between the kerbstones. It is also the main street of Brentford, with shops on both sides of it, and a line of electric tramway passes through the street, leaving but 2 feet on each side of the cars.

Very little care being given to road widenings in external London, example at Brentford.

It is enough to state these dimensions to show that the position at Brentford has become intolerable. Various proposals have been made for dealing with the difficulties which have partly arisen from former neglect, and partly created by modern legislation. It is to be hoped that the cure will be a radical one in the direction of making a wide arterial thoroughfare or a new street, marked "P" on Plan No. 8, not merely sufficient for the present traffic, but with some regard to the needs of the future.

Position at Brentford.

Plan No. 8.

Similar instances of constriction on main routes out of London, owing to their passage through suburban towns and villages near London, are numerous. We have already alluded to Fulham and Putney, which are now almost urban in their character; but other examples exist at Richmond, Kingston, Croydon, Greenwich and Woolwich, Bow, Stratford, Tottenham, Enfield, and other places.

Other instances of constriction on main routes.

At the present time, in the absence of some controlling authority, the width of roads in many of the suburbs is defined merely with reference to local convenience and the wishes of the owners of building sites. In these cases there is apparent the same want of provision for arterial necessities and of thought for the future, under which the Metropolis itself is suffering at the present time.

Absence of controlling authority.

We do not propose to discuss all these instances in detail, nor to prepare an exhaustive list. We merely desire to point out the importance of losing no time in curing evils which have arisen, and of preventing any extension of the vicious system which separates local control and interest from the general interests of the millions of inhabitants of London. The necessity for cure is urgent, and the cost of amelioration, large as it now may be, will inevitably become greater as time goes on.

Importance of immediate action.

As a matter of general policy for London, we would urge that all such streets as evidently require widening should be so declared and

General policy for London.

scheduled without delay, and that all occupation of forecourts or gardens within a prescribed distance from the centre of the roadway, should be forbidden under proper arrangements for compensation. Failure or delay to acquire such forecourts and gardens, and permitting them to be occupied by buildings, will greatly increase the expense of future widenings, and postpone important and desirable improvements.

Intersection of traffic.

Apart from new arterial streets and roads such as have been discussed, the subject of intersection of traffic demands very careful attention, as the delays at many points, from this cause alone, are serious and materially affect the carrying power of some of the leading thoroughfares. It is impossible in such a report as this to deal with more than a few selected instances, but those which we mention are important points of obstruction, and will serve to illustrate the case of numerous others in London of perhaps less significance. We may observe that the police attach the greatest importance to eliminating or minimising the effect of the intersection of traffic, and that the annual expense of regulating the crossing traffic is very considerable.

Tables and diagrams giving examples of points of intersection.

We submit particulars of a large number of points of intersection, which we have examined, and at which the amount and direction of the intersecting traffic has been observed. We give in the Appendix exhaustive tables and diagrams showing the volume and direction of traffic for each hour, and each class of vehicle, at the points enumerated in the following tables. The two main routes of Shepherd's Bush to Whitechapel, and Hammersmith Broadway to the Mansion House Station, are dealt with in the four following tables, and the relevant tables and diagrams in the Appendix are referred to in each case.

Tables XXXIII. to XXXVIII.

Tables XXXIII. to XXXVI.

Diagram No. 5, facing page 58 of this Report, shows the aggregate of vehicular traffic for one day of twelve hours from 8 a.m. till 8 p.m. on the two main routes under consideration divided into passenger and goods vehicles. The passenger vehicles, including cycles, are shown speckled, and are considered as "fast" traffic, and the goods vehicles, including barrows, are shown cross-hatched, and are considered as "slow" traffic. This diagram only denotes the volume of the east and west traffic, and does not in any way indicate direction, nor does it show the traffic crossing the routes.

Diagram No. 5.

Diagram No. 5A, facing page 58 of this report, shows details of vehicular traffic for one day of twelve hours, 8 a.m. till 8 p.m., and during the "busiest hour," on the main route from Shepherd's Bush to Whitechapel, together with the minimum widths of roadway. Diagram No. 5B, facing page 58 of this report, shows the same details for the main route from Hammersmith Broadway to the Mansion House Station. These diagrams only denote the volume of the east and west traffic, and do not in any way indicate direction or ultimate destination, nor do they show the traffic crossing the main route.

Diagram No. 5A.

Diagram No. 5B.

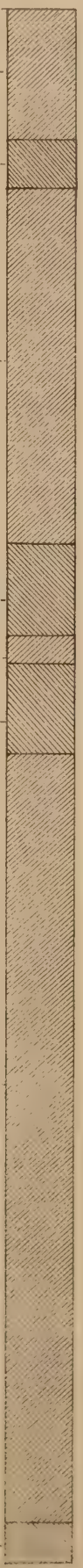
ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

WIDENING KING'S ROAD CHELSEA TO A WIDTH OF 100 FEET FROM FULHAM HIGH ST. TO SLOANE SQUARE.

DIAGRAM OF AREAS.

Total Area	617,436	square feet	
Open spaces	51,360	"	"
Building land	19,866	"	"
Gardens	140,630	"	"
Yards	36,311	"	"
Areas	11,564	"	"
One story buildings	35,542	"	"
Buildings more than one story	306,410	"	"
Public Houses	15,753	"	"



NOTE. In all cases the areas given are the net areas required exclusive of any surplus land.

Wells Gardner, Darton & Co. Ltd.

Table XXXIII.

SHEPHERD'S BUSH TO WHITECHAPEL ROUTE.

Volume of Vehicular Traffic for Twelve Hours.

Points of Observation.	Table Number in Appendix.	Diagram Number in Appendix.	Number of Vehicles of all Classes. Between the hours of 8 a.m. and 8 p.m.						
			Going East.	Going West.	Total East and West.	Going North.	Going South.	Total North and South.	Grand Total.
Uxbridge Road at Goldhawk Road	9	6	4,470	4,732	9,202	–	–	–	9,202
Uxbridge Road at Ladbroke Grove	10	8	4,447	4,732	9,179	259	–	259	9,438
High Street Notting Hill Gate, at Notting Hill Gate Station.	11	9	3,813	4,681	8,494	1,911	1,892	3,803	12,297
Bayswater Road at Queen's Road	12	10	3,728	4,585	8,313	1,394	–	1,394	9,707
Bayswater Road at Westbourne Street.	13	11	3,580	4,624	8,204	2,652	3,129	5,781	13,985
Marble Arch	14	12	6,585	6,256	12,841	7,974	8,505	16,479	29,320
Oxford Street at Orchard Street	15	14	7,305	6,435	13,740	3,784	2,693	6,477	20,217
Oxford Street at New Bond Street	16	15	7,287	7,075	14,362	1,053	2,323	3,376	17,738
Oxford (or Regent) Circus	17	16	6,933	7,611	14,544	3,722	5,962	9,684	24,228
Oxford Street at Berners Street	18	18	6,811	6,681	13,492	1,367	850	2,217	15,709
Oxford Street at Tottenham Court Road.	19	19	6,008	6,909	12,917	3,977	4,442	8,419	21,336
New Oxford Street at Bloomsbury Street.	20	21	6,214	5,833	12,047	2,444	2,351	4,795	16,842
New Oxford Street at Museum Street.	20	21	6,359	6,006	12,365	5,020	5,214	10,234	22,599
High Holborn at Broad Street	20	21	8,394	5,499	13,893	–	2,610	2,610	16,503
High Holborn at Red Lion Street	21	22	6,982	6,720	13,702	888	–	888	14,590
High Holborn at Chancery Lane	22	23	7,639	7,129	14,768	–	2,103	2,103	16,871
Holborn at Gray's Inn Road	22	23	8,467	7,966	16,433	3,758	–	3,758	20,191
Holborn Circus	23	24	6,062	9,244	15,306	3,327	2,273	5,600	20,906
Holborn Viaduct at Old Bailey	24	25	5,602	6,733	12,335	1,690	1,605	3,295	15,630
Newgate Street at The General Post Office.	25	26	6,287	6,284	12,571	3,763	3,331	7,094	19,665
Cheapside at King Street	26	28	5,347	5,439	10,786	1,942	2,252	4,194	14,980
The Bank	26	28	6,393	11,514	17,907	4,803	4,813	9,616	27,523
Cornhill at Bishopsgate Street Within.	27	30	2,799	2,666	5,465	3,264	3,009	6,273	11,738
Leadenhall Street at St. Mary Axe	28	32	2,834	2,917	5,751	705	417	1,122	6,873
Aldgate at Duke Street	29	33	4,181	2,995	7,176	450	695	1,145	8,321
Aldgate High Street at Minories	29	33	5,555	4,333	9,888	1,930	2,387	4,317	14,205
Whitechapel High Street at Commercial Road East.	30	35	7,213	6,450	13,663	2,777	1,492	4,269	17,932

Table XXXIV.

SHEPHERD'S BUSH TO WHITECHAPEL ROUTE.

Volume of Vehicular Traffic during "Busiest Hour."

Points of Observation.	Table Number in Appendix.	Diagram Number in Appendix.	Number of Vehicles of all Classes. During "Busiest Hour."						
			Going East.	Going West.	Total East and West.	Going North.	Going South.	Total North and South.	Grand Total.
Uxbridge Road at Goldhawk Road	9	7	600	497	878	–	–	–	878
Uxbridge Road at Ladbroke Grove	10	–	601	496	831	33	–	33	864
High Street Notting Hill Gate, at Notting Hill Gate Station.	11	–	629	329	824	211	204	382	1,206
Bayswater Road at Queen's Road	12	–	534	344	820	174	–	174	994
Bayswater Road at Westbourne Street.	13	–	544	377	897	409	498	850	1,747
Marble Arch	14	13	487	718	1,205	1,041	932	1,864	3,069
Oxford Street at Orchard Street	15	–	511	840	1,223	406	374	730	1,953
Oxford Street at New Bond Street	16	–	504	625	1,219	131	257	383	1,602
Oxford (or Regent) Circus	17	17	686	724	1,359	402	611	962	2,311
Oxford Street at Berners Street	18	–	689	693	1,272	163	92	239	1,511
Oxford Street at Tottenham Court Road.	19	20	555	716	1,267	446	408	764	2,031
New Oxford Street at Bloomsbury Street.	20	–	577	592	1,169	261	240	492	1,661
New Oxford Street at Museum Street.	20	–	600	636	1,236	541	471	961	2,197
High Holborn at Broad Street	20	–	839	550	1,389	–	259	259	1,648
High Holborn at Red Lion Street	21	–	809	788	1,597	102	–	102	1,699
High Holborn at Chancery Lane	22	–	764	713	1,477	–	218	218	1,695
Holborn at Gray's Inn Road	22	–	671	796	1,467	410	–	410	1,877
Holborn Circus	23	–	619	930	1,549	377	254	580	2,129
Holborn Viaduct at Old Bailey	24	–	564	647	1,311	175	167	328	1,639
Newgate Street at The General Post Office.	25	27	636	603	1,239	395	365	759	1,844
Cheapside at King Street	26	–	510	549	1,059	233	252	485	1,544
The Bank	26	29	661	1,108	1,769	503	497	930	2,699
Cornhill at Bishopsgate Street Within.	27	31	294	276	570	367	320	677	1,189
Leadenhall Street at St. Mary Axe	28	–	301	292	593	90	61	125	718
Aldgate at Duke Street	29	34	462	203	574	59	261	294	868
Aldgate High Street at Minories	29	34	582	577	970	213	238	422	1,377
Whitechapel High Street at Commercial Road East.	30	36	717	710	1,177	299	182	481	1,550

Note.—The traffic toward the various points of the compass does not, in some cases, reach its maximum at the same hours, and, therefore, for the "busiest hour" the totals of the east and west traffic, and the north and south traffic, are not always the sum of the maximum traffic at each of the above points.

Table XXXV.

HAMMERSMITH BROADWAY TO MANSION HOUSE STATION ROUTE.

Volume of Vehicular Traffic for Twelve Hours.

Points of Observation.	Table Number in Appendix.	Diagram Number in Appendix.	Number of Vehicles of all Classes. Between the hours of 8 a.m. and 8 p.m.						
			Going East.	Going West.	Total East and West.	Going North	Going South	Total North and South	Grand Total.
Hammersmith Broadway	31	37	2,826	5,074	7,900	1,144	2,543	3,687	11,587
Kensington Road at Holland Road	32	39	2,488	3,453	5,941	1,565	745	2,310	8,251
Kensington Road at Earl's Court Road	33	40	3,134	2,976	6,110	—	1,646	1,646	7,756
Kensington High Street at Church Street	34	41	4,026	4,324	8,350	2,550	—	2,550	10,900
Kensington High Street at Kensington Palace Gardens	34	41	4,024	4,113	8,137	569	—	569	8,706
Kensington Road at Gloucester Road	35	42	3,601	4,134	7,735	—	1,208	1,208	8,943
Kensington Road at Queen's Gate	36	43	3,756	3,823	7,579	228	819	1,047	8,626
Kensington Road at Exhibition Road	37	44	3,784	3,963	7,747	629	745	1,374	9,121
Knightsbridge at Sloane Street	38	45	9,162	9,982	19,144	—	2,327	2,327	21,471
Knightsbridge at Grosvenor Place	39	47	7,527	6,203	13,730	319	1,703	2,022	15,752
Hyde Park Corner	39	47	7,004	7,135	14,139	7,576	7,571	15,147	29,286
Piccadilly at Berkeley Street	40	49	8,331	6,169	14,500	2,658	—	2,658	17,158
Piccadilly at Dover Street	40	49	8,175	8,323	16,498	1,079	—	1,079	17,577
Piccadilly at St. James's Street	40	49	7,328	8,128	15,456	1,863	3,155	5,018	20,474
Piccadilly at Old Bond Street	40	49	7,255	7,245	14,500	2,311	—	2,311	16,811
Piccadilly Circus	41	51	5,844	5,290	11,134	11,918	3,998	15,916	27,050
Waterloo Place	42	53	4,870	3,170	8,040	4,096	59	4,155	12,195
Pall Mall at Haymarket	42	53	7,547	6,315	13,862	3,274	—	3,274	17,136
Charing Cross	43	54	6,721	8,932	15,653	3,773	8,342	12,115	27,768
West Strand at Duncannon Street	43	54	3,687	5,359	9,046	3,196	1,444	4,640	13,686
Strand at King William Street	43	54	5,395	8,349	13,744	—	—	—	13,744
Strand at Bedford Street	43	54	5,668	7,930	13,598	393	—	393	13,991
Strand at Wellington Street	44	56	5,804	6,118	11,922	2,676	5,145	7,821	19,743
Fleet Street at Chancery Lane	45	58	4,550	4,745	9,295	2,051	—	2,051	11,346
Fleet Street at Fetter Lane	45	58	4,566	4,146	8,712	1,185	—	1,185	9,897
Ludgate Circus	46	59	4,862	4,366	9,228	6,849	6,879	13,728	22,956
St. Paul's Churchyard	47	61	4,983	4,060	9,043	3,573	—	3,573	12,616
Mansion House Station[1]	48	62	3,477	4,567	8,044	6,049	6,015	12,064	20,108

[1] For the purposes of this table, the traffic in Cannon Street is considered as going east and west, and that in Queen Victoria Street as going north and south.

Table XXXVI.

HAMMERSMITH BROADWAY TO MANSION HOUSE STATION ROUTE.

Volume of Vehicular Traffic during "Busiest Hour."

Points of Observation.	Table Number in Appendix.	Diagram Number in Appendix.	Number of Vehicles of all Classes. During "Busiest Hour."						
			Going East.	Going West.	Total East and West.	Going North.	Going South.	Total North and South.	Grand Total.
Hammersmith Broadway	31	38	237	550	767	121	289	400	1,153
Kensington Road at Holland Road	32	–	246	393	639	175	89	264	903
Kensington Road at Earl's Court Road.	33	–	285	377	662	–	182	182	844
Kensington High Street at Church Street.	34	–	240	353	593	288	–	288	881
Kensington High Street at Kensington Palace Gardens.	34	–	221	371	592	87	–	87	679
Kensington Road at Gloucester Road.	35	–	179	331	510	–	131	131	641
Kensington Road at Queen's Gate	36	–	222	359	581	53	110	142	723
Kensington Road at Exhibition Road.	37	–	228	366	594	89	96	173	767
Knightsbridge at Sloane Street	38	46	958	1,023	1,946	–	285	285	2,153
Knightsbridge at Grosvenor Place	39	–	757	620	1,377	42	173	215	1,592
Hyde Park Corner	39	48	698	740	1,371	757	872	1,575	2,902
Piccadilly at Berkeley Street	40	50	828	726	1,554	297	–	297	1,851
Piccadilly at Dover Street	40	50	783	798	1,581	121	–	121	1,702
Piccadilly at St. James's Street	40	50	742	775	1,517	232	332	550	2,067
Piccadilly at Old Bond Street	40	50	755	701	1,456	248	–	248	1,704
Piccadilly Circus	41	52	575	531	1,084	1,204	401	1,586	2,670
Waterloo Place	42	–	743	374	1,117	697	7	701	1,818
Pall Mall at Haymarket	42	–	830	634	1,464	340	–	340	1,804
Charing Cross	43	55	704	1,027	1,602	447	814	1,231	2,642
West Strand at Duncannon Street	43	–	591	317	908	338	160	498	1,406
Strand at King William Street	43	–	539	840	1,379	–	–	–	1,379
Strand at Bedford Street	43	–	566	817	1,073	47	–	47	1,120
Strand at Wellington Street	44	57	573	600	1,080	251	541	757	1,821
Fleet Street at Chancery Lane	45	–	455	474	929	211	–	211	1,140
Fleet Street at Fetter Lane	45	–	457	415	872	142	–	142	1,014
Ludgate Circus	46	60	491	438	870	809	666	1,475	2,252
St. Paul's Churchyard	47	–	594	463	1,057	406	–	406	1,463
Mansion House Station[1]	48	63	382	386	768	698	708	1,406	2,174

[1] For the purposes of this table, the traffic in Cannon Street is considered as going east and west, and that in Queen Victoria Street as going north and south.

Note.—The traffic toward the various points of the compass does not, in some cases, reach its maximum at the same hours and, therefore, for the "busiest hour" the totals of the east and west traffic, and the north and south traffic, are not always the sum of the maximum traffic at each of the above points.

Table XXXVII.

"ELEPHANT AND CASTLE" TO BLACKFRIARS BRIDGE (North End) ROUTE.

Volume of Vehicular Traffic for Twelve Hours and during "Busiest Hour."

Points of Observation.	Table Number in Appendix	Diagram Number in Appendix.	Number of Vehicles of all Classes. Between the Hours of 8 a.m. and 8 p.m. Going East.	Going West.	Total East and West.	Going North.	Going South.	Total North and South.	Grand Total.
"Elephant and Castle" - - -	49	64	2,619	4,797	7,416	3,035	5,725	8,760	16,176
Blackfriars Bridge Approach and Stamford Street.	50	66	4,203	3,524	7,727	6,494	2,993	9,487	17,214
Blackfriars Bridge (North end) -	51	68	6,004	4,784	10,788	6,500	7,097	13,597	24,385
			During "Busiest Hour."						
"Elephant and Castle" - -	49	65	320	576	694	373	606	84	1,499
Blackfriars Bridge Approach and Stamford Street.	50	67	447	377	815	748	403	956	1,667
Blackfriars Bridge (North end) -	51	69	788	539	1,254	650	711	1,282	2,461

TABLE XXXVIII.

FULHAM ROAD AND KING'S ROAD, CHELSEA, ROUTE.

Volume of Vehicular Traffic for Twelve Hours and during "Busiest Hour."

Points of Observation.	Table Number in Appendix.	Diagram Number in Appendix.	Number of Vehicles of all Classes. Between the Hours of 8 a.m. and 8 p.m. Going East.	Going West.	Total East and West.	Going North.	Going South.	Total North and South.	Grand Total.
Fulham Road at the Cancer Hospital.	52	–	2,625	2,761	5,386	–	–	–	5,386
Fulham Road at Stamford Bridge -	52	–	2,623	2,735	5,358	–	–	–	5,358
King's Road, Chelsea, at Sloane Square.	53	–	2,351	2,336	4,687	–	–	–	4,687
King's Road, Chelsea, at Beaufort Street.	53	–	1,772	1,997	3,769	–	–	–	3,769
			During "Busiest Hour."						
Fulham Road at the Cancer Hospital.	52	–	257	305	533	–	–	–	533
Fulham Road at Stamford Bridge -	52	–	366	318	528	–	–	–	528
King's Road, Chelsea, at Sloane Square.	53	–	231	313	488	–	–	–	488
King's Road, Chelsea, at Beaufort Street.	53	–	179	222	401	–	–	–	401

Note.—The traffic toward the various points of the compass does not, in some cases, reach its maximum at the same hours and, therefore, for the "busiest hour" the totals of the east and west traffic, and the north and south traffic, are not always the sum of the maximum traffic at each of the above points.

The numerous tables and diagrams in the Appendix will repay study in detail, as they show the number and direction of the streams of traffic at each place. Examples of the diagrams, as given in the Appendix, will be found facing this page and pages 56 and 60 of this report, viz., those showing: Vehicular Traffic at the Bank from 8 a.m. till 8 p.m.; and during "busiest hour;" and traffic delays. Diagram No. 29. Diagram No. 73.

Tables of vehicular traffic counts.

In order to ascertain, as far as possible, the cause of congestion and consequent loss of speed and delay to vehicular traffic between east and west, and especially with reference to two of the most important routes, viz.: (1) Shepherd's Bush to Whitechapel, *via* Bayswater Road, Oxford Street, High Holborn, Newgate Street, Cheapside, Cornhill, Leadenhall Street, and Aldgate; (2) Hammersmith Broadway to Mansion House Station, *via* Kensington Road, Knightsbridge, Hyde Park Corner, Piccadilly, Regent Street, Waterloo Place, Charing Cross, Strand, Fleet Street, Ludgate Hill, St. Paul's Churchyard, and Cannon Street, a systematic count of all vehicles using these two routes during the twelve hours, between 8 a.m and 8 p.m., has been made. The returns are complete for each hour, and the results, together with those taken at a few other points, will be found in Tables Nos. 9 to 53 in the Appendix. Each table applies to some important side road, and gives, in detailed form, the traffic joining, leaving, and, where this occurs, crossing, the main route. At certain points, the traffic in the main route is also given. The traffic as given in the tables has been divided into eight classes: (1) Omnibuses; (2) Selected Carriers[1] Carts and Vans; (3) Other Trade Vehicles; (4) Two-wheeled Cabs; (5) Four-wheeled Cabs; (6) Carriages; (7) Barrows; and (8) Cycles. Tramway cars have also been enumerated separately in the few cases where they exist. As the area of roadway occupied by the last two classes, barrows and cycles, is small in comparison with other vehicles, a total has been given in the tables in all cases excluding them as well as a grand total including them. *Tables Nos. 9 to 53.*

Diagrams of vehicular traffic.

Graphic representations of these results are shown in Diagrams Nos. 6 to 69 in the Appendix. The centre lines of the adjacent roads are geographically correct (except at a few points duly noted on the diagrams) and drawn to the Ordnance scale of 88 feet to 1 inch. The volume of traffic in each district is shown to a scale of 10,000 vehicles to a width of 1 inch on the diagrams relating to the traffic from 8 a.m. till 8 p.m. and to a scale of 1,000 vehicles to a width of 1 inch on the diagrams relating to the "busiest hour." To enable the trend of the traffic to be followed readily, the same scheme of colouring has been adopted throughout—traffic going east being shown in red, that going west in red hatched with black, that going north in blue, and that going south in blue hatched with black. *Diagrams Nos. 6 to 69.*

The traffic from 8 a.m. till 8 p.m. along the two east and west routes before-mentioned is intended to form a continuous diagram for each route, and, for this reason, the through traffic lines are carried to the edge of the sheets. The figures, however, giving the volume of this through traffic are not always consecutive on adjacent sheets, as, owing to the large number of separate points that had to be counted, it was obviously impossible to have the whole of the counts taken on the same day. This remark also applies to Diagrams Nos. 5, 5A, and 5B, page 58.

Shepherd's Bush to Whitechapel route.

To facilitate comparison of one point with another on the two routes under consideration, tables accompanying the diagrams have been prepared, and from them and from the diagrams it will be observed that, in the case of the Shepherd's Bush to Whitechapel route (Tables Nos. 9 to 30 and Diagrams Nos. 5 and 5A and Nos. 6 to 36), the volume of traffic for twelve hours going east and west, between the Marble Arch and the Bank, does not vary to any great extent throughout the greater portion of that length; but that the vehicles turning out north or south are replaced by those entering from the side roads. *Tables Nos. 9 to 30.* Diagrams Nos. 5, 5A, 28, 29. *Diagrams 6 to 36.*

[1] "Selected Carriers" include all Railway Companies' vans and all those of the following public carriers, viz.:—The Atlas Express Company; Messrs. Chaplin & Co.; the Globe Parcel Express; Messrs. Sutton & Co.; Messrs. Thompson, McKay & Co.; the London Parcels Delivery Co.; Messrs. Carter, Paterson & Co.; and Messrs. Pickford & Co.

Vehicular traffic at "busiest hour."

It must, however, be borne in mind that an average of the traffic during the whole of twelve hours does not fairly represent the condition of affairs at any moment of time at which a "block" may occur. In order to illustrate more approximately that state of affairs, diagrams showing the vehicular traffic during the "busiest hour" at various points of observation are also given. In selecting the "busiest hour" we have thought it right to take the hour which shows the largest traffic apart from barrows and cycles, though these are included in the figures given.

Traffic "busiest hour" one-tenth of 12-hour day.

The broad result is that the traffic of the "busiest hour" is one-tenth of the traffic for the twelve hours, thus showing that between 8 a.m. and 8 p.m. there must be a very high average of traffic for the whole of the time.

Variations in balance of traffic going east and west.

It will be observed that, in many cases where the "busiest hour" occurs during the early morning or in the evening, there is a marked difference in the balance of traffic going east and west. Thus, at the Marble Arch (Diagram No. 13 in the Appendix, 6 p.m. till 7 p.m.) the traffic going west along Oxford Street exceeds that going east by nearly 100 per cent. at that hour, and, from Table No. 14 in the Appendix, we can deduce the fact that, in the morning, the traffic going east exceeds that going west by about 50 per cent., showing that, in the morning, it is distributed over a longer period than is the stream going west in the evening. The same may be observed at many other points.

Diagram No. 13.
Table No. 14.

Evil of having lamp-posts, &c., in the roadway.

Incidentally it may be pointed out that this want of balance in the volume of traffic going in opposite directions illustrates the harmfulness of dividing a congested roadway by centre tramway columns, lamp posts, &c., or more foot-passenger refuges than are absolutely necessary. This is a subject to which we shall again call attention later on in this report. The temptation that such obstructions offer to the drivers of fast vehicles to pass on the wrong side is a well known source of danger to the public.

Hammersmith Broadway to Mansion House Station route.

Turning now to the tables and diagrams relating to the Hammersmith Broadway to Mansion House Station route (Tables Nos. 31 to 48 and Diagrams Nos. 5 and 5B and Nos. 37 to 63), it will be seen that the volume of traffic is fairly constant west of Knightsbridge, where the Brompton Road traffic joins it, and that the traffic in Piccadilly and again in Cockspur Street is extremely heavy.

Tables Nos. 31 to 48.
Diagrams Nos. 5, 5B.
Diagrams 37 to 63.

Eight represesentative crossings.

Dealing now with eight representative crossings, we find that the following number of vehicles either cross each other at right angles or diverge at the places under consideration :—

TABLE XXXIX.

NUMBER OF VEHICLES USING EIGHT REPRESENTATIVE CROSSINGS.

Points of observation.	Per day of 12 hours, 8 a.m. till 8 p.m. No. of Vehicles.	At "busiest hour." No. of Vehicles.	Table in Appendix.	Diagram in Appendix.
Marble Arch	(1) 29,320	(1) 3,069	No. 14	Nos. 12 and 13
Hyde Park Corner	(2) 29,286	(2) 2,902	No. 39	Nos. 47 and 48
Piccadilly :—at St James's Street	(7) 20,474	(7) 2,067	No. 40	Nos. 49 and 50
Piccadilly Circus	(5) 27,050	(4) 2,670	No. 41	Nos. 51 and 52
Charing Cross	(3) 27,768	(5) 2,642	No. 43	Nos. 54 and 55
Strand :—at Wellington Street	(8) 19,743	(8) 1,821	No. 44	Nos. 56 and 57
Ludgate Circus	(6) 22,956	(6) 2,252	No. 46	Nos. 59 and 60
Bank	(4) 27,523	(3) 2,699	No. 26	Nos. 28 and 29

Effect of "season."

These are, however, the results for one day in the year only, and that for the Marble Arch during the "season." It is more than likely that in the winter months, the Bank or Charing Cross would head the list.

Effect of configuration of junction.

If we now examine the diagrams, with a view to ascertaining the causes of congestion due to the configuration of the various junctions, it is at once apparent that, as a rule, by far the largest number of vehicles cross at right angles, and that the diverging traffic is not nearly so important; but direct cross traffic at right angles to that along the main routes, such as that at Oxford Circus (Diagrams Nos. 16 and 17 in the Appendix), Tottenham Court Road (Diagrams Nos. 19 and 20 in the Appendix), Wellington Street (Diagrams Nos. 56 and 57 in the Appendix), and Ludgate Circus (Diagrams Nos. 59 and 60 in the Appendix), does not cause congestion to the east and west traffic to the same extent as is the case where roads, taking a great deal of cross traffic, are not opposite each other, such as at the Marble Arch (Diagrams Nos. 12 and 13 in the Appendix). At that point the traffic from the Edgware Road has to join the traffic going east and to form part of it, before it can continue down Park Lane and *vice versa*. The same may be seen between Shaftesbury Avenue and Hart Street (Diagram No. 21 in the Appendix), Gray's Inn Road and St. Andrew's Street (Diagrams Nos. 23 and 24 in the Appendix), St. Martin's-le-Grand and St. Paul's Churchyard (Diagrams Nos. 26 and 27 in the Appendix), and between Queen Victoria Street and Princes Street (Diagrams Nos. 28 and 29 in the Appendix and facing pages 54 and 56 of this report).

Diagrams Nos. 16, 1 19, 20, 5 57, 59, 6 12, 13, 2 23, 24, 2 27, 28, 2 Diagrams Nos. 12, 1- Diagram No. 21. Diagrams Nos. 23, 2- Diagrams Nos. 26, 2- Diagrams Nos, 28, 2-

Other causes of congestion.

The obstructions at these various points are not, however, in themselves sufficient to account for the congestion towards the City-end of the routes under consideration. There are several other causes which contribute to congestion which cannot be conveniently shown in diagramatical form. The chief of these are:—(*a*) The great variation in the width of roadway, without the least regard to traffic requirements; (*b*) The frequency of side roads carrying a large amount of traffic; (*c*) The gradual change in the class of vehicles comprising the traffic.

Variation of widths of roadway.

Dealing with these causes of congestion in order, it may be noted, with regard to the first, (*a*) that, on the Shepherd's Bush to Whitechapel route, (*see* Diagrams Nos. 5 and No. 5A, facing page 58) at the end of the Bayswater Road, immediately west of the Edgware Road, the width of the roadway is about 63 feet, with a traffic of 11,816 vehicles between 8 a.m. and 8 p.m., and of 1,232 vehicles between 6 p.m. and 7 p.m., and that, opposite the Marble Arch, the width of the roadway is 49 feet, with a traffic of 22,471 vehicles between 8 a.m., and 8 p.m., and of 2,331 between 6 p.m. and 7 p.m. In other words, into a thoroughfare reduced by 20 per cent. in width, nearly 100 per cent. more traffic is brought. Again in New Oxford Street, between Shaftesbury Avenue and Museum Street, with a roadway of 33 feet, a traffic of 20,370 vehicles between 8 a.m. and 8 p.m., and approximately 2,000 in the "busiest hour," has to pass. This is a volume nearly equal to that at the Marble Arch. On the Hammersmith Broadway and Mansion House Station route, we have at the east end of Knightsbridge a roadway of over 70 feet wide, and a traffic of 13,914 vehicles between 8 a.m. and 8 p.m., and of 1,451 vehicles between 5 p.m. and 6 p.m.; and in the Strand, east of Bedford Street, a roadway of only 30 feet, and a traffic volume of 13,837 vehicles in twelve hours, and 1,073 between 4 p.m. and 5 p.m. Many other instances of the great disproportion between the width of roadway and the volume of traffic might be quoted.

Diagrams Nos. 5, 5-

Frequency of side roads.

With regard to the second cause, (*b*), if we take the points at which the counts have been taken, it will be found that, on the Shepherd's Bush and Whitechapel route, west of New Bond Street, a distance of $3\frac{1}{4}$ miles, there are 15 side roads, with a total traffic of 50,850 vehicles in twelve hours either crossing, joining, or leaving the main stream of traffic; while, between New Bond Street and the Bank, a distance of $2\frac{1}{2}$ miles, there are 30 lines of crossing, confluent or diverging traffic, with a total volume of 142,874 vehicles in twelve hours; and no provision has been made in the main artery for this great interference with the free flow of traffic. The same applies, though not quite to so great an extent, on the Hammersmith Broadway and Mansion House Station route. (*See* Diagrams Nos. 5 and 5B, facing page 58).

Diagrams Nos. 5, 5B

Change in class of vehicles as one goes Citywards.

The third cause, (*c*), of increasing congestion as one goes Citywards, is brought out very clearly in the summary table given on each diagram in

the Appendix. In each of such tables the total traffic, in both directions, in each roadway shown on the diagram is given. This total traffic is divided up into three classes, viz. : (1) Goods Vehicles; (2) Passenger Vehicles; (3) Barrows and Cycles; and shows at a glance the proportion that these classes bear to each other. For our purpose, it will be sufficient for the present to refer to the first two classes only, which may be considered as "slow" and "fast" traffic respectively. A careful comparison of these tables will show the tendency for the proportion of "slow" traffic to increase towards the City-end of both the routes under consideration, not only on the main routes (*See* Diagrams Nos. 5A and 5B, facing page 58), but, to an even larger extent, on the cross roads and side streets. (*See* Diagrams Nos. 6 to 63 in Appendix).

Diagrams Nos. 5A, 5B.

Diagrams Nos. 6 to 63.

Goods and passenger vehicles.

The following summary shows the number of goods and passenger vehicles respectively, and, from it, will be seen that, on the more northern route from Shepherd's Bush to Whitechapel, the number of "slow" vehicles exceeds the number of "fast" vehicles at some point between Tottenham Court Road and the General Post Office, with the one exception of the Bank; and there the excess of passenger vehicles is largely due to the great number of omnibus routes which converge at that point. On the more southerly route from Hammersmith Broadway to the Mansion House Station, the balance changes at some point between Wellington Street and Ludgate Circus.

TABLE XL.

SHEPHERD'S BUSH TO WHITECHAPEL ROUTE.

SUMMARY OF STREET TRAFFIC—DIVIDED INTO GOODS AND PASSENGER VEHICLES.

DURING 12 HOURS, 8 a.m. till 8 p.m.

Junction.	Goods Vehicles.	Passenger Vehicles.	Diagram in Appendix.
Marble Arch	7,314	17,880	No. 12
Oxford (or Regent) Circus	5,375	15,949	No. 16
Oxford Street and Tottenham Court Road	6,161	11,740	No. 19
The General Post Office	9,277	7,103	No. 26
The Bank	8,592	15,828	No. 28
Cornhill and Bishopsgate Street Within	4,809	4,701	No. 30
Aldgate, Houndsditch, and Minories	9,570	2,195	No. 33
Whitechapel High Street and Commercial Road East	11,571	3,609	No. 35

TABLE XLI.

HAMMERSMITH BROADWAY TO MANSION HOUSE STATION ROUTE.

SUMMARY OF STREET TRAFFIC—DIVIDED INTO GOODS AND PASSENGER VEHICLES.

DURING 12 HOURS, 8 a.m. till 8 p.m.

Junction.	Goods Vehicles.	Passenger Vehicles.	Diagram in Appendix.
Knightsbridge and Sloane Street	5,182	14,179	No. 45
Hyde Park Corner	7,963	18,799	No. 47
Piccadilly Circus	5,715	20,223	No. 51
Charing Cross	6,323	19,503	No. 54
Strand and Wellington Street	6,818	11,012	No. 56
Ludgate Circus	12,139	7,651	No. 59
Mansion House Station	7,620	10,590	No. 62

Mixed nature of London traffic.

These tables further show the very mixed nature of London's traffic. It cannot be said that at any of these junctions the traffic is essentially of a goods nature or of a passenger nature, and we shall refer to the varying percentages of each class later on.

Lessons from the tables and diagrams.

Effect of short lengths of road widenings.

It does not, therefore, appear that, as far as regards the two routes under consideration, short lengths of road widenings are likely to prove of any lasting benefit. It is usually found that any local improvement tends to attract traffic to that route, and thus to increase the congestion at those points which have not been dealt with.

Circuses and road widenings at junctions.

Road widenings at junctions and the formation of circuses are undoubtedly of great local value. The recently completed widening of Piccadilly at Hamilton Place has enabled the very large traffic in and out of the latter street to cross the main east and west traffic with a great reduction of delay. A further obvious benefit of having an increased area of roadway at congested junctions is that, when the traffic has to be "held up" by the police, there is plenty of room for it to accumulate on a broad front, until allowed to pass on, and that therefore the time occupied in passing is lessened. Another great advantage of increased width of roadway at junctions is that room is left for such vehicles, as merely wish to turn into the side street, to do so. For example, at Piccadilly Circus, when the traffic from Regent Street south of the Circus is checked there is room for such traffic, as so wishes, to proceed westwards along Piccadilly. But at Ludgate Circus it will be seen that, as a result of the roadway of Fleet Street being only 36 feet in width, and being as a rule full of vehicles, the traffic wishing to proceed northwards along Farringdon Street is so surrounded as to be unable to free itself from the traffic going eastwards until the "block" is removed. Both these cases can be seen at the present crossing of the Strand at Wellington Street, where the "block" is accentuated by the steep gradient of the latter street. Here it is possible for a vehicle from the widened Strand east of the junction to turn by the improved corner southwards to Waterloo Bridge, but quite impossible as a general rule for a vehicle coming from the west to turn the sharp corner up Wellington Street out of the Strand, the northern half of which is blocked by waiting vehicles while the north and south traffic is crossing the Strand. We shall again refer to crossings of this description.

Improvements at junctions only local.

It must again be pointed out that improvements at junctions are only local, and, although, in our opinion, they are urgently called for, and will be of great benefit, they will only, to a certain extent, relieve the congestion of the routes in question. As regards the two routes under consideration, it is certain that the traffic along them at the present time has quite outgrown their capacity apart from any provision for the increase that may be expected year by year.

Alternative routes.

East and west "Main Avenue."

Extension of Mall.

Widening of Constitution Hill.

St. James's Street and Berkeley Street crossing.

It is only by opening up alternative routes, parallel to the known requirements of the traffic that any permanent relief to the existing traffic and provision for the future can be hoped for. That is one of our reasons for recommending the east and west "Main Avenue." We also believe that the extension of The Mall to Charing Cross, the widening of Constitution Hill, and our recommendation with regard to the cross traffic at St. James's Street and Berkeley Street, marked "S" on Plan No. 8, to which we refer later on, would, if carried out, do much to relieve Piccadilly.

Pla No.

Traffic delays.

The foregoing tables and diagrams, and details in the Appendix referred to, do not show the extent of delay to traffic at each point, but we have had returns prepared of four representative crossings, showing the aggregation of time during which the traffic is "held up" at each place.

TABLE XLII.

TRAFFIC DELAYS.

Junction.	Aggregate of stoppages per day of 12 hours from 8 a.m. till 8 p.m.						Aggregate of stoppages during "busiest hour."							Number in Appendix.	
	North and South Traffic.			East and West Traffic.				North and South Traffic.			East and West Traffic.				
	Number of Delays.	Total Time of Delays.	Total Number of Vehicles.	Number of Delays.	Total Time of Delays.	Total Number of Vehicles.	"Busiest Hour."	Number of Delays.	Total Time of Delays.	Total Number of Vehicles.	Number of Delays.	Total Time of Delays.	Total Number of Vehicles.	Table.	Diagram
Piccadilly:		hrs. min.			hrs. min.				mins.			mins.			
At St. James's Street	214	3 41·4	5,018	230	1 47·3	15,456	4—5 p.m.	31	43·5	550	31	15·7	1,517	No. 54	No. 70
Strand:															
At Wellington Street*	245	3 32·5	7,821	259	4 6·5	11,922	4—5 p.m.	18	25·0	757	21	29·5	1,080	No. 55	No. 71
Ludgate Circus	297	3 41·2	13,728	301	4 42·6	9,228	9—10 a.m.	27	18·7	1,475	29	23·9	870	No. 56	No. 72
Bank:															
At Princes Street	337	6 5·3†	3,059	—	—	—	11 a.m.—noon.	31	37.7†	277	—	—	—	No. 57	No. 73
At King William Street	314	4 41·9†	4,822	—	—	—	11 a.m.—noon.	31	24·9†	451	—	—	—	No. 57	No. 73
At Queen Victoria Street	—	—	—	262	2 16·4†	5,620	11 a.m.—noon.	—	—	—	31	18·3†	626	No. 57	No. 73
In Mansion House Street	—	—	—	324	3 6·4‡	10,967	11 a.m.—noon.	—	—	—	31	15·9‡	1,125	No. 57	No. 73
In Mansion House Street	—	—	—	240	2 39·7§	4,943	11 a.m.—noon.	—	—	—	30	19·8§	540	No. 57	No 73
At Threadneedle Street	—	—	—	324	5 5·5†	5,459	11 a.m.—noon.	—	—	—	29	32·0†	564	No. 57	No. 73
At Cornhill	—	—	—	315	5 1·4†	3,216	11 a.m.—noon.	—	—	—	32	31·6†	313	No. 57	No. 73
In Mansion House Street	—	—	—	181	1 4·3†	5,385	11 a.m.—noon.	—	—	—	22	7·7†	503	No. 57	No. 73

* From observations made by the London County Council in 1902; delays of less than 30 seconds not recorded.

† Traffic in one direction only, viz.: going south out of Princes Street and north out of King William Street; going east out of Queen Victoria Street, and west out of Threadneedle Street and Cornhill, and west out of Mansion House Street to Poultry.

‡ All eastward traffic in Mansion House Street.

§ Eastward traffic in Mansion House Street to Cornhill and King William Street.

Note.—Except in the case of the Strand at Wellington Street, the delays were not observed on the same days as the traffic counts were made; therefore the number of vehicles must be taken as representative.

Traffic delays at crossings.

Piccadilly at St. James's Street.

From the tables and diagrams in the Appendix showing traffic delays and the above table, it will be seen that the north and south traffic at St. James's Street was, on the day observed, delayed 214 times for a total period of 3 hours 41·4 minutes or over 30 per cent. of the time during the 12 hours, 8 a.m. till 8 p.m., and 31 times for a total period of nearly 43·5 minutes or 73 per cent. during the "busiest hour," 4 p.m. till 5 p.m. The east and west traffic in Piccadilly was delayed 230 times for a total period of 1 hour 47·3 minutes, or 15 per cent., and 31 times for a total period of 15·7 minutes, or 26 per cent. during the 12 hours and "busiest hour" respectively. The hour of most delay to the north and south traffic was between 6 and 7 p.m., when this traffic was stopped 36 times for a total period of 43·9 minutes, or 73 per cent., and to the east and west traffic between 5 and 6 p.m., when that traffic was held up 31 times for a total period of 20·3 minutes, or 34 per cent.

Table XLII.

Table No. 54.

Diagram No. 70.

Strand at Wellington Street.

At Wellington Street the north and south traffic was delayed 245 times between 8 a.m. and 8 p.m. for a total period of 3 hours 32·5 minutes, or over 29 per cent. of the time, and 18 times during the "busiest hour," 4 p.m. till 5 p.m., for a total period of 25 minutes, or over 41 per cent. The east and west traffic in the Strand was delayed 259 times between 8 a.m. and 8 p.m. for a total period of 4 hours 6·5 minutes, or over 34 per cent. of the time, and 21 times during the "busiest hour," 4 p.m. till 5 p.m., for a total period of 29·5 minutes, or nearly 50 per cent. of the time. Delays of less than 30 seconds were not recorded at this crossing. The hour of most delay to the north and south traffic was between 1 and 2 p.m., when this traffic was stopped 23 times for a total period of 27·5 minutes, or 46 per cent., and to the east and west traffic between 1 and 2 p.m., when that traffic was "held up" 24 times for a total period of 31 minutes, or 52 per cent.

Table No. 55.

Diagram No. 71.

Ludgate Circus

At Farringdon Street and New Bridge Street the north and south traffic was delayed 297 times between 8 a.m. and 8 p.m. for a total period of 3 hours 41·2 minutes, or nearly 31 per cent. of the time, and 27 times during the "busiest hour," 9 a.m. till 10 a.m., for a total period of 18·7 minutes, or 31 per cent. of the time. The east and west traffic in Fleet Street and Ludgate Hill was delayed 301 times between 8 a.m. and 8 p.m. for a total period of 4 hours 42·6 minutes, or over 39 per cent. of the time, and 29 times during the "busiest hour," 9 a.m. till 10 a.m., for a total period of 23·9 minutes, or nearly 40 per cent. of the time. The hour of most delay to the north and south traffic was between 4 and 5 p.m., when this traffic was stopped 34 times for a total period of 28 minutes, or 47 per cent., and to the east and west traffic between 5 and 6 p.m., when that traffic was "held up" 35 times for a total period of 35·8 minutes, or 60 per cent.

Table No. 56.

Diagram No. 72.

Bank.

The traffic out of Princes Street going south was delayed 337 times between 8 a.m. and 8 p.m. for a total period of 6 hours 5·3 minutes, or over 50 per cent. of the time, and 31 times during the "busiest hour," 11 a.m. till noon, for a total period of 37·7 minutes, or nearly 63 per cent. of the time. The hour of most delay to this traffic was between 10 a.m. and 11 a.m., when the traffic was stopped 30 times for a total period of 39·5 minutes, or 66 per cent. of the time.

Table No. 57.

Niagram Do. 73, facing.

The traffic out of King William Street going north was delayed 314 times between 8 a.m. and 8 p.m. for a total period of 4 hours 41·9 minutes, or 39 per cent. of the time, and 31 times during the "busiest hour," 11 a.m. till noon, for a total period of 24·9 minutes, or 41 per cent. of the time. The hour of most delay to this traffic was between 3 p.m. and 4 p.m., when the traffic was stopped 29 times for a total period of 31·9 minutes, or 53 per cent. of the time.

The traffic out of Queen Victoria Street going east was delayed 262 times between 8 a.m. and 8 p.m. for a total period of 2 hours 16·4 minutes, or 19 per cent. of the time, and 31 times during the "busiest hour," 11 a.m. till noon, for a total period of 18·3 minutes, or 30 per cent. of the time. The hour of most delay to this traffic was between 10 a.m. and 11 a.m., when the traffic was stopped 35 times for a total period of 25·5 minutes, or 43 per cent. of the time.

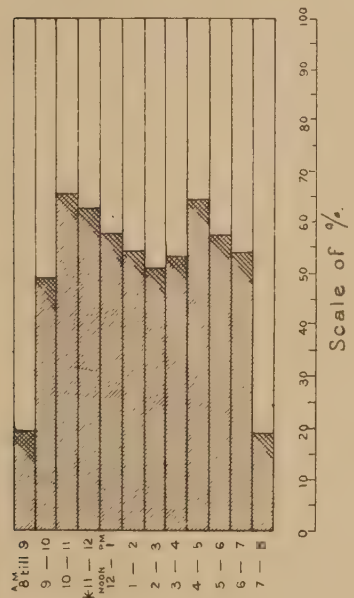
DIAGRAM Nº 73
(See Table Nº 57.)
Sheet Nº 1.

DIAGRAM SHOWING EXTENT OF CROSS TRAFFIC DELAYS.

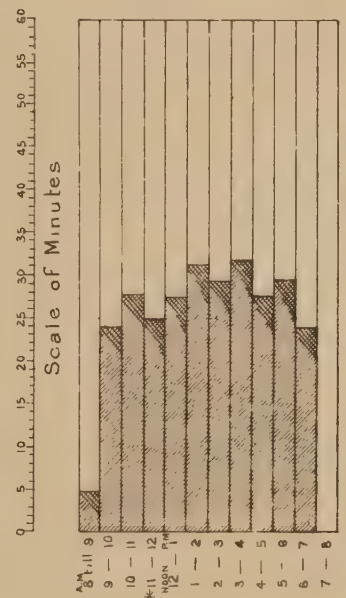
AT THE BANK.

FRIDAY AUGUST 12TH 1904.

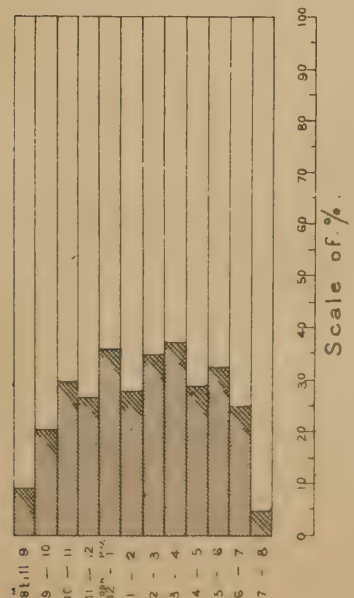
OUT OF PRINCES STREET
SOUTHWARD TRAFFIC



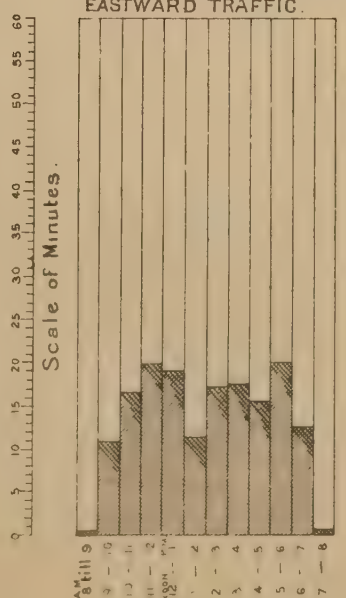
OUT OF KING WILLIAM STREET
NORTHWARD TRAFFIC



IN MANSION HOUSE STREET
ALL EASTWARD TRAFFIC.



IN MANSION HOUSE STREET
TO CORNHILL AND
KING WILLIAM STREET.
EASTWARD TRAFFIC.



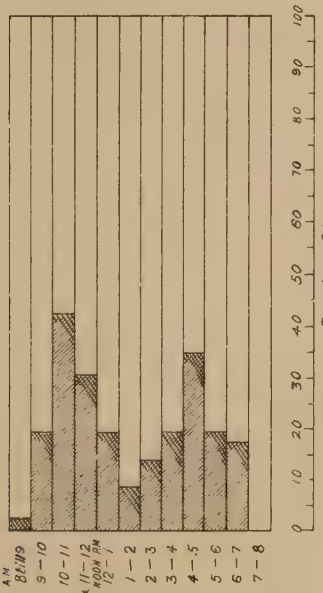
*NOTE According to the Traffic Count made on July 11th & 12th the "Busiest Hour" for this Junction is from 11am. till 12 noon.

DIAGRAM Nº 73. (CONTINUED) (See Table Nº 57.) Sheet Nº 2.

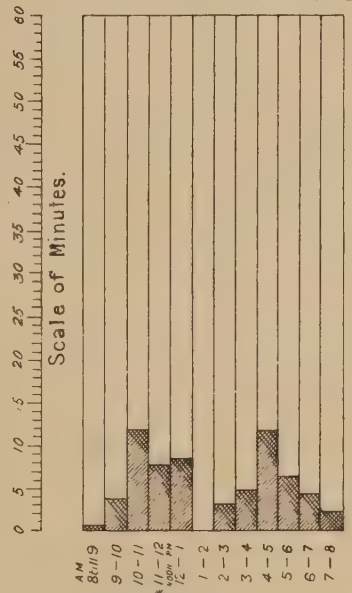
DIAGRAM SHOWING EXTENT OF CROSS TRAFFIC DELAYS AT THE BANK (CONTINUED.)

FRIDAY AUGUST 12TH 1904.

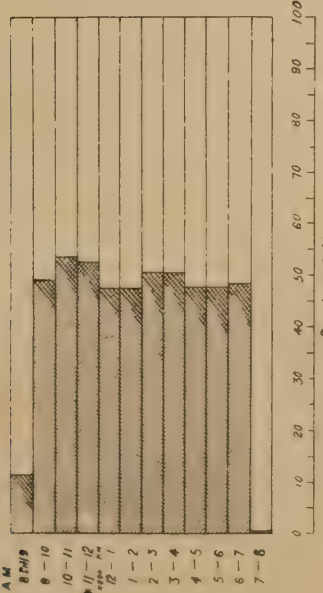
IN QUEEN VICTORIA STREET
EASTWARD TRAFFIC



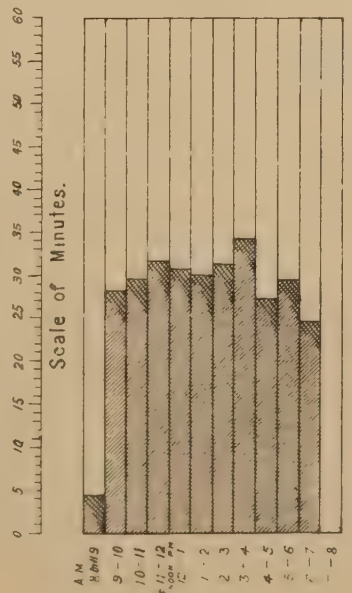
IN MANSION HOUSE STREET
TO POULTRY
WESTWARD TRAFFIC



OUT OF THREADNEEDLE STREET
WESTWARD TRAFFIC



OUT OF CORNHILL
WESTWARD TRAFFIC



* NOTE According to the Traffic Count made on July 11th & 12th the "Busiest Hour" for this Junction is from 11 a.m. till 12 noon.

Waller & Graham Ltd Lith. London

Table No. 57. Diagram No. 73.

The whole of the traffic in Mansion House Street going eastward was delayed 324 times between 8 a.m. and 8 p.m. for a total period of 3 hours 6·4 minutes, or 26 per cent. of the time, and 31 times during the "busiest hour," 11 a.m. till noon, for a total period of 15·9 minutes, or 26 per cent. of the time. The hour of most delay to this traffic was between 3 p.m. and 4 p.m., when the traffic was stopped 27 times for a total period of 22 minutes, or 37 per cent. of the time.

The traffic in Mansion House Street going eastward to Cornhill and King William Street was delayed 240 times between 8 a.m. and 8 p.m. for a total period of 2 hours 39·7 minutes, or 22 per cent. of the time, and 30 times during the "busiest hour," 11 a.m. till noon, for a total period of 19·8 minutes, or 33 per cent. of the time. This was also the hour of most delay.

The traffic out of Threadneedle Street going west was delayed 324 times between 8 a.m. and 8 p.m. for a total period of 5 hours 5·5 minutes, or 42 per cent. of the time, and 29 times during the "busiest hour," 11 a.m. till noon, for a total period of nearly 32 minutes, or 53 per cent. of the time. The hour of most delay to this traffic was between 10 a.m. and 11 a.m., when the traffic was stopped 31 times for a total period of 32·2 minutes, or 54 per cent. of the time.

The traffic out of Cornhill going west was delayed 315 times between 8 a.m. and 8 p.m. for a total period of 5 hours 1·4 minutes, or 42 per cent. of the time, and 32 times during the "busiest hour," 11 a.m. till noon, for a total period of 31·6 minutes, or 53 per cent. of the time. The hour of most delay to this traffic was between 3 p.m. and 4 p.m., when the traffic was stopped 30 times for a total period of 34·2 minutes, or nearly 57 per cent. of the time.

The traffic in Mansion House Street going westward to Poultry was delayed 181 times between 8 a.m. and 8 p.m. for a total period of 1 hour 4·3 minutes, or 9 per cent. of the time, and 22 times during the "busiest hour," 11 a.m. till noon, for a total period of 7·7 minutes or 13 per cent. of the time. The hour of most delay to the traffic was between 10 a.m. and 11 a.m., when the traffic was stopped 29 times for a total period of nearly 12 minutes, or 20 per cent. of the time.

As before stated, the "busiest hour," as shown on the vehicular traffic diagrams, is the hour during which the traffic from all directions reaches its maximum, and it would appear that the maximum amount of delay at the crossings under consideration does not, except in the case of the eastward traffic in Mansion House Street to Cornhill and King William Street, coincide with the "busiest hour," nor with the number of times the traffic is "held up," nor with the volume of traffic during the hour, as it is impossible that such regulations should be automatic, and the personal element and the judgment as to what is best in the interest of the whole traffic must be and is exercised.

Class of vehicles.

As in the case of the flow of traffic in the main routes already alluded to, so at the crossings, an important matter is to study the descriptions of vehicular traffic at those different points. It will be seen that, roughly speaking, the traffic may be classified as under: –

TABLE XLIII.

Description of Vehicular Traffic at Five Crossings.

Description of Vehicles.	At Marble Arch.		In Piccadilly:—at St. James's Street.		In Strand:—at Wellington Street.		At Ludgate Circus.		At Bank.	
		Per cent.		*Per cent.*		*Per cent.*		*Per cent.*		*Per cent.*
Omnibuses	4,745	16	5,028	25	4,485	23	4,546	20	7,760	28
Cabs and carriages	13,135	45	9,264	45	6,527	33	3,105	14	8,068	30
Carts and waggons	7,314	25	4,212	20	6,818	35	12,139	53	8,592	31
Barrows	310	1	306	2	814	4	981	4	1,178	4
Cycles	3,816	13	1,664	8	1,099	5	2,185	9	1,925	7
	29,320	100	20,474	100	19,743	100	22,956	100	27,523	100

Relative numbers of classes of vehicles differ greatly at different points.

The relative numbers of the various kinds of vehicles thus differ greatly at various spots. For example, even at the highest, omnibuses only represent 28 per cent. of the total vehicular traffic including barrows and cycles at the Bank, and only 16 per cent. at the Marble Arch. Cabs and carriages amount to 45 per cent. at Piccadilly and the Marble Arch, and only 14 per cent. at Ludgate Circus. Carts and waggons are 53 per cent. of the total vehicular traffic at Ludgate Circus, and only 20 per cent. in Piccadilly. These proportions are significant, as it is sometimes thought that omnibuses are the most important factors in the congestion of the traffic and are the largest users of the streets of London, and that, if by the introduction of tramways they would be removed, matters might adjust themselves to the present dimensions of our streets. It is clear that this substitution would only effect from 16 to 28 per cent. of the total volume, and we think it might be assumed that the total number of tramcars would not differ greatly from the number of omnibuses, for, although each tramcar would carry more passengers than an omnibus, we think that a better description of vehicle would attract a greater number of travellers. We doubt very much whether tramcars, however efficient, will, with the habits of London, and the demand for rapidity, displace many cabs and carriages.

Percentage of omnibuses.

Substitution of tramcars for omnibuses would not do away with necessity for wider streets.

Over or under crossings for road traffic.

Holborn Viaduct.

There can be no doubt that the most satisfactory mode of dealing with such points of intersection is by the construction of bridges or viaducts, or roads inclined downwards. And here we wish to draw attention to the vast improvement effected by the City of London about 1869 in the construction of the Holborn Viaduct, which got rid not only of a most congested point of intersection, but also of the steep gradients of Snow Hill and Holborn Hill. As to the loss of money involved by this point of crossing it is instructive to refer to the able report by the late Col. Haywood in relation to the traffic of the City and the improvements needed in the public ways, which was presented to "The Select Committee of the Worshipful "the Committee upon Improvements of The Corporation of the City of "London," on 27th February, 1867. The author of the report stated, "It has "been given in evidence before a Government Commission, that the loss "incurred in carriage traffic alone on Holborn and Ludgate Hills represented "£100,000 annually, and that calculation was made 20 years ago, when the "traffic was much smaller than it is now." The estimate was quite irrespective of the value of time to passengers or increased cost of goods and coal to the consumer. The author went on to say :—" Thus, inadequate thorough-"fares are not only inconvenient but are expensive to the public; "lead to police regulations which impede the free and natural course of the "traffic and business of a community, and are repugnant to the spirit of "the age. Evidence may, at the present time, be adduced in support of "these views, by reference to the Traffic Bill now (1867) before the Houses "of Parliament. By it the hours during which coals can be delivered are "to be much restricted, and it is computed by one who has unusual oppor-"tunities of forming a sound opinion on the subject, that it will result in "the price of coals being increased to the consumer by as much as 2*s.* 6*d.* "per ton, involving a total loss to the metropolitan inhabitants of between "£400,000 and £500,000 annually." The Holborn Viaduct is an improvement on which the City is to be congratulated as being a far-seeing and large-minded enterprise which has been of great benefit to London. It is a satisfaction to learn that out of a total first cost of £2,522,406 the "recoupments" from property have amounted to £951,406, and the debt has been extinguished to the extent of £1,183,700, leaving only £387,300 still unpaid.

Col. Haywood's Report, Feb. 27, 1867.

Estimated saving to carriage traffic by construction of Holborn Viaduct.

Loss by restriction on coal traffic.

Cost of Holborn Viaduct improvements.

Coal and Wine Duties.

The Holborn Viaduct and other great improvements were largely paid for out of the Coal and Wine Duties, of which the former amounted, shortly before abolition, to about £500,000 annually, and ceased by Act of Parliament in 1890, and the latter to about £8,500 annually, ceasing, also by Act of Parliament, in 1888. One cannot help feeling that, if these duties had continued to be levied, some of the works which are now urgently required would be in existence. We may perhaps here refer to the evidence[1] given before the Royal Commission by Mr. R. W. Perks, M.P., in which he points out that London owes the important works of improvement during the latter

[1] Mr. R. W. Perks, M.P., Q. 19865, Vol. II.

half of the last century to the Coal and Wine Duties, and in which he states that he would be an advocate in Parliament for their re-imposition.

Cross traffic at Ludgate Circus and Queen Victoria Street.

Referring now to points of intersecting traffic, a matter which urgently requires amelioration, it will be observed that at Ludgate Circus the north and south traffic over Blackfriars Bridge cuts directly across the traffic of Fleet Street and Ludgate Hill, and, 250 yards south of Ludgate Circus, across the important and growing traffic of the Victoria Embankment and Queen Victoria Street.

As important as Holborn Viaduct was.

There can be no doubt that at this spot the interference with the free flow of traffic, so far as numbers are concerned, must be worse than was the case at the Holborn Hill crossing in 1866, when the Holborn Viaduct was undertaken. Further than this, the confusion at Ludgate Circus will become more and more objectionable as time goes on.

Traffic and delays at Ludgate Circus.

We have seen that, at the present time, in a busy hour 1,475 vehicles cross 870 vehicles at right angles, and the east and west traffic is "held up" by the police for 34 minutes, and the north and south traffic for 19 minutes out of the "busiest hour."

East and west viaducts very difficult.

At first sight one would recommend a second Holborn Viaduct in an east and west direction. Owing, however, to the existence of the bridge of the London, Chatham and Dover Railway at its crossing of Ludgate Hill any new roadway viaduct in a direction east and west would have to be of an otherwise unnecessary height, and would consequently interfere with a great length of very expensive property. There is another objection to a viaduct in that direction, viz., that it would do nothing for the intersection of traffic at Queen Victoria Street, which may soon become of almost equal importance with that of Ludgate Hill, and will assume fresh importance if tramways are introduced.

Plan No. 8.

Viaduct from Blackfriars Bridge to Farringdon Street recommended.

We think, therefore, that what is required here is the construction of a viaduct, marked "Q" on Plan No. 8, running north and south, commencing at the centre arch of Blackfriars Bridge (the roadway of which would have to be widened), passing down the centre of New Bridge Street and Farringdon Street, and terminating in Farringdon Street between Farringdon Avenue and Plumtree Court. The viaduct would have a gradient of 1 in 42 at its south end and 1 in 40 at its north end, and a minimum headway of 18 feet at Ludgate Circus. The width of the roadway would be 33 feet, which would give room for two lines of tramways with two lines of ordinary vehicular traffic, but footways would be unnecessary. There would be a space at each side of the viaduct on the widened Blackfriars Bridge for a roadway of 27 feet and a pathway of 14 feet, thus giving room for one line of tramway with two lines of ordinary vehicular traffic at each side. The viaduct would be carried on columns placed at the outer edge of the existing pathways in Bridge Street, and would leave that roadway under the viaduct as it exists at present; but in Farringdon Street a widening would be necessary on the east or west sides, as the consideration of the value of property might point out, giving a space at each side of the north incline of the viaduct of 40 feet or a roadway of 25 feet, and a footway of 15 feet.

Sir Henry Knight's proposed viaduct.

Sir Henry Knight suggested, in his evidence[1] before the Royal Commission a narrow viaduct commencing in New Bridge Street at Tudor Street and ending in Farringdon Street at Stonecutter Street, of a width of 18 feet and approaches at both ends of 1 in 30, with a headway at Ludgate Circus of 16 feet. This viaduct would be carried down the centre of New Bridge Street on pillars, and all light cab and carriage traffic would be diverted over it, the roadway also having two lines of tramway. The space at each side of this viaduct would be 14 feet in New Bridge Street and 25 feet in Farringdon Street for slow cart traffic, which would still, as now, cross Ludgate Circus on the level, and the cross traffic at Queen Victoria Street would be undealt with and remain an ever-growing inconvenience.

Injury to property and cost of larger viaduct.

There would be considerable injury to the property in New Bridge Street, Ludgate Circus and Farringdon Street by either of these schemes, and the cost of carrying out the more complete measure suggested by us,

---

Sir Henry Knight, Q. 14504, Vol. II. Plate LIII., Vol. VI.

viz., £700,000, would, of course, be considerably more than that of Sir Henry Knight's scheme.

The larger scheme recommended.

Notwithstanding the extra cost, we are of the opinion that this is a case where measures only partly efficacious are to be deprecated, and where an improvement as important as, and comparable to, that of the Holborn Viaduct, should be faced, and the present serious loss of time and money avoided.

Traffic at Wellington Street, Strand.

The next point of intersecting traffic to which we shall allude is at Wellington Street, Strand, marked "R" on Plan No. 8. The amount of cross traffic at this spot during busy hours is very considerable, and is indicated in the preceding Table XLIII at page 61 and Diagrams Nos. 56 and 57 and Table No. 44 in the Appendix. The chief amount of intersection arises from the north and south traffic crossing the east and west traffic at right angles, though the amount of traffic diverging to the Strand is not inconsiderable. The traffic in the Strand at this spot is held up during the "busy hours" for 29·5 minutes out of an hour (Table No. 55, and Diagram No. 71 in Appendix). Owing to the steep hill, 1 in 24, of Wellington Street approaching the Strand from the north, the construction of a bridge over the Strand presents but little engineering difficulty, and the gradient of Wellington Street would merely be transferred, though greatly improved, to an incline ending at the north-west end of Waterloo Bridge, the abutment of which might require to be widened. If there is no reasonable hope of the construction of a new bridge across the Thames to the westward of the Temple, to which we have already alluded in connection with one of the "Main Avenues," and which would also carry the north and south road traffic over the Strand, we think that a bridge across the Strand at Wellington Street should certainly be made. The Chief Engineer of the London County Council pointed out some objections on the score of gradient and possible interference with Waterloo Bridge,[1] but we do not attach importance to either matter, so far as the particular proposal is concerned, as the interference with the bridge could be made extremely small. The cost of a bridge across the Strand at Wellington Street and its approaches, after allowing for "recoupment" in property, has been estimated at about £325,000. The Engineer of the London County Council, however, raised another consideration of more importance,[2] viz., that, apart from the question of any bridge across the Strand, he recognises the necessity of better accommodation for the north and south traffic over the Thames than the narrowness of Waterloo Bridge can afford. The roadway of the bridge is only 27 ft. 6 ins. in width, with footways of 7 ft. 5 ins. He states that, except in case of necessity, he would deprecate a complete widening of Waterloo Bridge, as it would involve interference with the whole structure, especially with the foundations, which have in times past shown signs of weakness, and which, during the last 20 years, have had to be strengthened by special works. Mr. Fitzmaurice urges that a new bridge on another site would be preferable, and that this could conveniently be made to cross over the Strand by a bridge, and so render a bridge at Wellington Street less necessary. We trust that the important intersection of the traffic of the Strand at Wellington Street will not be postponed indefinitely, unless the proposal for crossing the Thames by another bridge is adopted.

Plan No. 8.

Table XLIII. *Diagrams Nos. 56, 57. Table No. 44*

Table No. 55 Diagram No. 71.

Bridge over the Strand does not present any engineering difficulty.

New bridge over Thames west of the Temple.

Cost of bridge over the Strand at Wellington Street.

London County Council's Engineer raised another consideration.

Wellington Street improvement should not be lost sight of.

Where bridges are impracticable widening of junctions should be carried out.

There are, no doubt, other places in London at which bridges would be of great benefit, but in dealing with many cases of intersecting traffic, the obstruction must be minimised by widening of streets at least at their embouchure at the point of intersection, and by forming large circuses, so as to allow the conflicting streams to pass on a broad front.

Piccadilly at Berkeley Street and St. James's Street.

There is one point where great congestion exists during the summer months to which we will draw attention, and that is the crossing of Piccadilly by the north and south traffic at St. James's Street and Berkeley Street (Tables Nos. 40 and 54, and Diagrams Nos. 49, 50 and 70 in Appendix). At Berkeley Street a sunken roadway and short tunnel could without difficulty, from an engineering point of view, be carried under Piccadilly, joining a roadway along the eastern edge of the Green Park to the Mall; while short cross streets could be made into Jermyn Street and Pall Mall, marked "S" on Plan No. 8. The interference with the park would be small, but the idea involves the acquisition of a strip of land from the private gardens of Lansdowne House and Devonshire House. There would be no interference with

Tables Nos. 40, 54. Diagrams Nos. 49, 50, 70.

Plan No. 8.

Mr. Maurice Fitzmaurice, Qq. 6356, 6386, Vol. II.
Mr Maurice Fitzmaurice Q. 6398, Vol. II.

Lansdowne House itself, and the structure of Devonshire House need not be affected further than that part of the new roadway would pass beneath it. This roadway would be very useful, as it would relieve the crossing at the top of St. James's Street of very much of the north and south traffic. The present crossing is particularly objectionable: vehicles in St. James's Street waiting to enter Piccadilly have to stand on a gradient of 1 in 23.

Interference with Green Park, Devonshire House, and Lansdowne House.

We are sensible of the potency of æsthetic objections to interference with the Green Park and with the important private gardens on the west side of Berkeley Street. This last-mentioned matter may, however, in some future re-arrangement of property, be more feasible than it seems to be at the present moment.

Similar new street in Rome.

A somewhat similar work has recently been carried out in Rome, where, by means of a sunken road and a tunnel beneath valuable private property, the old town is connected with the modern Via Nazionale, and a number of steep, narrow, and tortuous streets avoided.

Widening at Marble Arch recommended.

Plan No. 8.

Diagrams Nos. 12, 13.

An example of a place where a great improvement by widening might be effected is at the Marble Arch, marked "T" on Plan No 8, where the east and west traffic is much confused and congested by the cross traffic between the Edgware Road and Park Lane (*see* Diagrams Nos. 12 and 13 in Appendix) already referred to. In this instance, if the Marble Arch could be set back into the Park so as to face the junction of the streets, and a large open space be made, as has been done at Hyde Park Corner, great relief would be given, not only to the main traffic of the streets, but also to the traffic in and out of the Park.

Widenings of streets at crossings.

We have said that enlargements of streets at crossings is most important, and there are many places at which, within the bounds of finance, this is the only way of alleviating the congestion due to the intersection of traffic. We might give as illustrations Piccadilly Circus, Oxford Circus, the north and south ends of Tottenham Court Road, and the "Elephant and Castle," but we do not pretend to exhaust the list of the spots where improved junctions are required.

Existing circuses too small.

This necessity has been in times past to some extent recognised by those who planned the various circuses which exist at some of the junctions of important streets, but the circuses, like the roadways, have been conceived on too small a scale for present requirements.

Obstruction by lavatories, statues, obelisks, fountains, and lamp pillars.

Unfortunately in the past the opportunity, afforded by such widened junctions and circuses as London possesses, has been seized, in several instances, to erect at them obstacles to the free flow of traffic of various kinds, such as stairs to lavatories, statues, obelisks, fountains, and lamp pillars of quite unnecessary dimensions. At all such points, where traffic is frequently "held up," we think the roadways should be cleared of all these obstructions, excepting only of very narrow islands required for pedestrian crossings, which should be placed further back than at present from the point of intersection. It should be always borne in mind that traffic, if it has to be "held up," should, as we have said, be marshalled on as wide a front as possible, and pass the point of intersection in that formation. Thus the power of diverging in all directions should in every way be facilitated by large circuses.

Cross traffic should be marshalled and passed on as wide a front as possible.

Evil of lamp-posts and tramway standards being placed in the centre of roadways.

While on this point, we wish to enter an earnest protest against the placing of lamp or tramway-trolley-wire standards in the centre of roadways at any point. The practice grew up no doubt from a mistaken idea of facilitating traffic by separating the up and down streams, on the assumption that the up and down traffic is equal in volume. This assumption is true only as an average, for, as a fact, the balance is always fluctuating as may be seen by reference to the tables and diagrams of vehicular traffic in the Appendix. With the varying pace of vehicles and necessary stoppages the longitudinal occupation of the centre of the road at frequent intervals with standards and their surrounding kerbs is most objectionable, and renders adjustment of pace so difficult that a wide thoroughfare is converted by them into two narrow and inconvenient lanes, which do not admit of the passage of the traffic nearly so well as one unobstructed street.

Obstruction by cab-ranks.

A still greater obstruction than central pillars is the existence, in many of our most important thoroughfares, of long cab-ranks. This subject is one of extreme difficulty. There is a public demand for the rapid hiring of cabs,

and the objection to loitering cabs is great. The side streets are usually too narrow for cab-ranks, and thus, as a choice of evils, long cab-ranks are to be found even in such inadequate main thoroughfares as, for example, the Strand, Piccadilly, Haymarket, Shaftesbury Avenue, Queen Victoria Street, and Victoria Street, Westminster. In fact, one may almost say that, whenever a main street is wide enough for more than four rows of vehicles, a cab-rank is placed in it by the Police. We do not know how to suggest any cure for the difficulties of the case, but it is one more proof of the undoubted fact that our streets are too narrow for the conditions which they have to fulfil. We suppose that, unless the requirements and tastes of Londoners alter in the future, the demand for cabs being readily available will remain, and that quicker means for going from place to place than an omnibus, or a tramcar must be provided for. Thus, unless some other situation can be found for cab-ranks than in the centre of main thoroughfares, some space in main streets must be provided for them and they must be considered, as much a necessity of London, as the right, under proper regulations, to load and unload vehicles at the doors of houses, shops, or warehouses. But the obstruction caused to the flow of through traffic by cab-ranks in the centre of main thoroughfares, is much greater than that caused to the same class of traffic by vehicles standing next the kerbs, as the former prevents the overtaking and passing of the slow traffic by the fast.

Standing vehicles at kerbs loading and unloading.

The subject of the right of frontagers to load and unload opposite their property is one which is much abused in many places, and requires to be systematized by regulations. While the right must be in itself respected for the conditions of ordinary trade or domestic purposes, there are many instances in which the frontage of important streets is occupied almost continuously for commercial purposes, by vehicles standing at the kerbstone during the business hours of the day. We allude to such businesses as those carried on at railway receiving offices, parcels and newspaper agencies and some warehouses. We think, in such instances, the vans should stand on private property, and not in the public thoroughfares. There can be no difficulty in this being done by devoting the area of the ground floor to standage for vans. It is simply a matter of cost. In many instances in the City, this mode of meeting the difficulties of the case has been adopted, and vans are drawn out of the street to loading banks. In our opinion this principle should be generally applied throughout London, in instances in which the occupation of property involves an unusual amount of loading and unloading. For example the condition of Regent Street near Piccadilly Circus, opposite the railway receiving-houses, has become almost intolerable. If traffic regulations forbade such lengthy occupation of the public street, the question would cure itself, as frontagers carrying on trades which require constant loading and unloading of vehicles would adapt their ground floors to the conditions of their trade

Railway receiving offices, &c.

Subways or bridges for pedestrians.

A matter to which our attention has been directed is the desirability of providing subways or bridges for the use of pedestrians crossing the streets. A good example of a subway for pedestrians exists at the Mansion House, though the approaches to it, by rather steep and narrow stairs, leave much to be desired. Making full allowance, however, for these shortcomings, we have at the Mansion House an excellent subway giving access to many streets under one of the most complicated and busiest crossings of vehicular traffic in the world, and one at which accidents to pedestrians are far too frequent. But as a result we find that only about 10 per cent. of the vast number of foot-passengers at the Mansion House crossings use the subways, and that the number does not increase. The result has been thus very disappointing and leads us to the belief that pedestrian subways and bridges will not be much used by the public if constructed at other places. Such subways are in themselves undesirable as matters of construction, as they interfere seriously with underground railways or "shallow" tramways and with subways for pipes. They also involve additional annual expenditure in watching by the police, lighting, and in ordinary maintenance. The experience at the Mansion House does not

thus warrant a recommendation for the general adoption of either subways or bridges for foot-passengers alone.

Situation of markets.

We have drawn attention to the very large amount of traffic in carts and waggons, which our enumeration of vehicles at various crossings and in some of the main thoroughfares discloses. Much of this is no doubt inseparable from the needs of such a city as London. But, on the other hand, we think that a large proportion of it is due to two causes that admit of remedy. The first is the existence of such markets as those of Covent Garden, Smithfield, Billingsgate, Leadenhall, Whitechapel, and Borough, which occupy the same positions as were fixed centuries ago, when the residential parts of London were differently situated, and when no other method than that of horse traction was known. We are well aware of the great difficulties of moving markets, which has been abundantly proved in times past, but we think the question should be considered, as to whether better situations could not be found for some of these markets, where railway and tramway accommodation could be afforded, and where shorter distances would exist between the markets and the areas of distribution. In any case the suggestion of Mr. J. H. Robinson, Alderman of Stepney,[1] to remove the Whitechapel Hay Market, which is held in the middle of an important thoroughfare, to the Mile-End Waste should be carried out without delay.

Whitechapel Hay Market.

Pneumatic tubes for small parcels, etc.

Lieutenant-Colonel R. E. Crompton, in his evidence before the Royal Commission,[2] submitted some interesting figures as to the proportion of the street traffic of London that is devoted to the carriage of small parcels, letters, newspapers, and messages, and gave as the result of observations, that this class of traffic represented at Ludgate Circus 25 per cent., at Newgate Street 21 per cent., and at Piccadilly and Oxford Street 10 per cent. of the total street traffic. He also pointed out[3] that, in the City of Philadelphia, the mails are being dealt with by 6-inch and 8-inch pneumatic tubes, and that the system has been adopted in New York, Boston, Chicago, and St. Louis, and that the tendency is to increase the size of the tubes in order to afford greater facilities for the mails. Notices have been given for a Bill in Parliament to authorize the laying of pneumatic tubes for parcels as well as mails.

Street improvements for future growth as well as for present needs.

When, however, all that is possible in the above directions has been done, with a view to lessen the present amount of traffic by carts and vans, there must still remain, in such a city as London, a very large amount of heavy traffic, and though, in the future, something may be effected towards more conveniently situated markets and better railway interchange for goods and parcels, we do not anticipate that these measures would do more than diminish the rate of future growth. What we have said, therefore, does not in any way affect our recommendations as to street improvements for future growth as well as for present needs.

Obstruction by costermongers' stalls and barrows.

The amount of obstruction in many important thoroughfares occasioned by the standing barrows and stalls of costermongers, is very serious, and requires to be dealt with. There can be no doubt that the business of costermongers is of much utility to the poorer classes and should not, lightly or hastily, be altogether suppressed. It might, however, and ought to be, regulated, and the barrows and stalls should be banished from main thoroughfares. We should think that authorized sites could be selected, or, if necessary, be made for costermonger traffic, much as is done in the little market places which are to be seen in many of our country towns and very usually on the Continent. The present want of system has resulted in serious obstruction of our streets, which are much too narrow for their legitimate traffic, and should undoubtedly give place to better arrangements.

Subordinate matters requiring attention.

There are many other subordinate matters demanding attention, which have been referred to by witnesses appearing before the Royal Commission, with whose views we entirely agree, such as: The objections to the excessive camber on roads (Qq. 7520, 17604, 18176, 17227, 17324, Vol. II.); The insufficient sanding and cleaning of roadways (Qq. 7533, 7817, 17235, 17324, 18176, Vol. II.); The varied material used in the construction of road surfaces (Qq. 6181, 18959, 18984, Vol. II.); The want of regulation of

[1] Mr. J. H. Robinson, Q. 9611, Vol. II.
[2] Lieut.-Col. R. E. Crompton, Q. 17886, Vol. II.
[3] Lieut.-Col. R. E. Crompton, Q. 17878, Vol. II.

omnibuses leaving stopping-places (Qq. 13387, 13393, 17309, Vol. II.); The obstruction to streets and footways during the erection of new buildings (Q. 8228, Vol. II.); The narrow width of swing bridges, and the use of hand-power for working them where public roads pass over dock entrances and passages (Qq. 9650, 9653, Vol. II.); The neglect of the "rule of the footway" by pedestrians (Q. 11726, Vol. II.); The thronging of the footways by persons waiting to enter places of amusement, in consequence of the frontage of such buildings not having been set back (Q. 9064, Vol. II.); The irregularity of the level and paving of private forecourts where not railed off (Q. 10017, Vol. II.).

We do not enlarge on these subsidiary matters, but they are all of importance, and are questions which should be systematised by more co-ordination between the various local authorities of London, and as to the regulation of which much might be learned from other great cities.

Michael Angelo Taylor's Act, 1817.

We have alluded to the neglect of street improvements in the past, and we feel that the word is not too strong. Owing to the existence of Michael Angelo Taylor's Act of Parliament of 1817, the local authorities of London could, for example, have provided many years ago, at but little cost, in most situations on the various roads alluded to in this report, much, if not all, the land required for wide commodious roadways. But they stood by passively, while building operations were undertaken, which, during the latter half of the nineteenth century, have converted gardens of large houses and fields and market gardens into land crowded with shops and houses abutting on narrow roadways.

Full advantage not taken of Act.

We cannot but feel also that even at the present moment full advantage is not being taken of Michael Angelo Taylor's Act by the Metropolitan Borough Councils. The officials of the London County Council are now, however, fully alive to the absolute necessity of wider streets in many parts of London, and with the co-operation of the Borough Councils this Act could be made available.

New Act required.

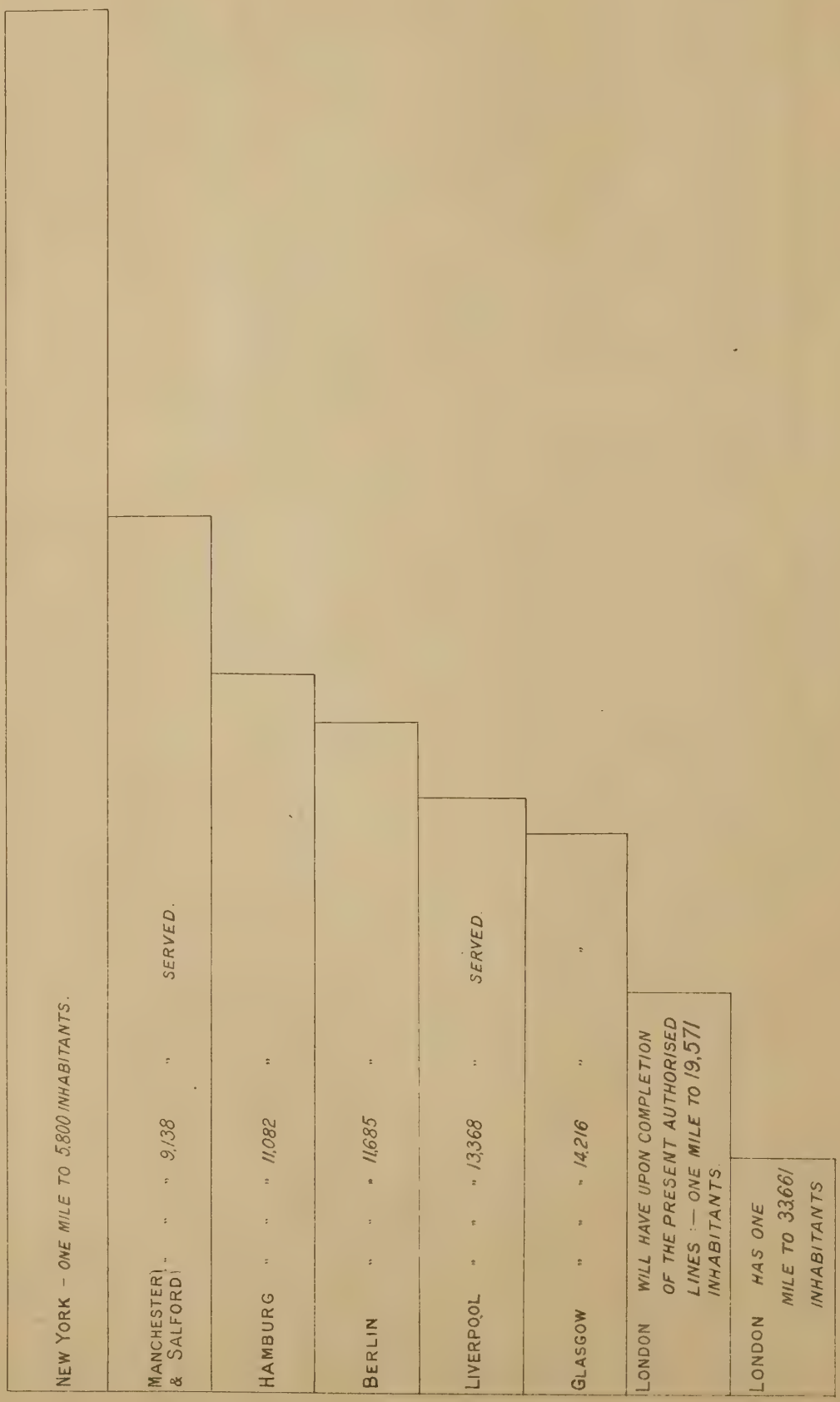
We suggest that all local authorities in "Greater London" should be enabled by a general Act of Parliament to acquire portions of properties (abutting on such streets and roadways as may be scheduled from time to time) which are required for widenings without being obliged, under the Lands Clauses Acts, to purchase the whole of such properties. We assume, of course, that proper compensation for the abstraction would be made. In many cases it seems probable that a house on a narrow roadway, which has a garden perhaps 30 feet deep, would not be of less value if it had a diminished garden, and the house remained with its frontage on a wider thoroughfare. We hereafter point out at least one important instance, viz., Victoria Street, Westminster, in which proprietors have covered over their open areas in order, for the purpose of their trades, to bring the tide of pedestrian traffic close up to the frontage line of their houses which are being converted from private dwellings into shops. What is wanted is, in addition to making new streets, to systematise the process of widening streets and to accelerate it by improved legislation.

DIAGRAM Nº74.

ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

DIAGRAM SHOWING MILEAGE OF TRAMWAYS TO NUMBER OF INHABITANTS IN VARIOUS TOWNS


NEW YORK – ONE MILE TO 5,800 INHABITANTS.
MANCHESTER & SALFORD " " 9,138 " SERVED.
HAMBURG " " " 11,082 "
BERLIN " " " 11,685 "
LIVERPOOL " " " 13,368 " SERVED.
GLASGOW " " " 14,216 "
LONDON WILL HAVE UPON COMPLETION OF THE PRESENT AUTHORISED LINES :— ONE MILE TO 19,571 INHABITANTS.
LONDON HAS ONE MILE TO 33,661 INHABITANTS

Weller & Graham, Ltd Litho. London.

TRAMWAYS.

Local urban and suburban passengers.

In London there are three classes of local urban and suburban passengers to be served: The short-distance, that is, the traveller who desires to go between two neighbouring points in the Metropolis; he that wishes to cover some intermediate distance, say, three or four miles; and the traveller who desires to go from one extremity of London, within a radius of, say, fifteen miles, to the centre. We shall classify the above as short-distance, intermediate-distance, and long-distance urban travellers. The ideal arrangement is made when separate facilities are provided for these several classes.

Best means of serving short-distance travellers.

In the present state of the means of transit, the most convenient, rapid, and the cheapest method of distributing passengers within a city's limits (the first of the above-mentioned classes) is by electric surface tramway. It is in respect of facilities of this character that London is far behind, not only cities in foreign countries, but other towns in the United Kingdom. The total mileage of tramway now working in "Greater London" is 203¼ miles, to be shortly raised to 350 miles by lines authorised but not yet constructed, serving a population of some 6,850,000; while Manchester and Salford, with a population[1] of 1,060,000, have 116 miles; Liverpool, with a population[1] of 798,000, has 59·7 miles; and Glasgow, with a population[1] of 1,000,000, has 70 miles. In other words, London has one mile of tramway to every 33,661 people, and will before long have one mile to every 19,571; Manchester and Salford one mile to every 9,138; Liverpool one mile to every 13,368; Glasgow one mile to every 14,216; and of typical foreign cities Hamburg has one mile to 11,082 persons; Berlin one mile to 11,685; and New York one mile to 5,800, as illustrated by Diagram No. 74, facing this page. In these cities and other provincial towns in the United Kingdom the tramway systems are laid out to convey passengers directly between the various commercial districts, or from and to such districts, to and from the residential quarters; and, as a general rule, they are under a single control.

Mileage of tramways in "Greater London."

Mileage of tramways in other cities.

Number of inhabitants per mile of tramway.

Diagram No. 74, facing.

In other cities tramways as a general rule under a single control.

Plan No. 9. Key Plan.

In "Greater London" the tramway systems, shown on Plan No. 9, attached to page 89, and the Key Plan facing page 88, of this report, may be divided into three main sections. Of these, (1) the "Northern and Eastern Section" lies wholly to the north of the Thames, and has its termini along the northern boundary of the City of London. With the exception of a few miles of line all the tramways in this section which are open for traffic are east of Regent's Park, covering the area within the County of London boundary, and extending northwards to Tottenham and Enfield, and eastwards through the districts of East and West Ham, Ilford and Barking. Of a total length of 54 miles in this section within the Administrative County of London, 48 miles are owned by the London County Council (shown in blue on Plan No. 9), but are leased to and worked by the North Metropolitan Tramways Company, which company, together with the Metropolitan Electric Tramways Company with which it is affiliated, owns or controls practically the whole of the remaining six miles. The lines to the north of the Administrative County of London boundary, and certain authorised lines to the north-west, are also owned or controlled by the Metropolitan Electric Tramways Company, and 8½ miles are now working. (These lines are shown in purple on Plan No. 9). Beyond the Administrative County of London to the eastward the tramways, for the most part, are owned and worked by the local authorities through whose districts they pass, and have a total length of about 31 miles. (These lines are shown in black on Plan No. 9).

London tramway systems divided into three main sections.

"Northern and Eastern Section."

Plan No. 9.

Plan No. 9.

Plan No. 9.

[1] These populations are the populations of the district served.

TABLE XLIV.

Route Mileage of Tramways and Light Railways (along public roads) wholly or mainly within "Greater London," including all lines authorised during the Parliamentary Session of 1904.

"NORTHERN AND EASTERN SECTION."

Tramway or Light Railway.	Route Mileage.				
	Working.		Authorised, but not in operation.		Total.
	Horse.	Electric.	Horse.	Electric.	
	M. Chs.	M. Chs.	M. Chs.	M. Chs.	M. Chs.
North Metropolitan	2 10	—	—	—	2 10
London County Council:—North Metropolitan Section	48 36	—	1 33	—	49 69
Metropolitan Electric	—	8 33	—	—	8 33
Harrow Road and Paddington	2 67	—	—	—	2 67
Middlesex and Hertford Light Railways	—	—	—	40 78	40 78
Highgate Hill (Cable)	—	0 57 (Cable).	—	—	0 57
Lea Bridge, Leyton and Walthamstow	4 70	—	—	—	4 70
Walthamstow Urban District Council	—	—	—	3 60	3 60
West Ham Corporation	—	7 77	—	1 16	9 13
Ditto. (worked by North Metropolitan Tramways Company)	3 27	—	—	—	3 27
East Ham Urban District Council	—	6 66	—	2 33	9 19
Ilford Urban District Council	—	6 56	—	—	6 56
Barking Town Urban District Council (Light Railway)	—	1 27	—	1 46	2 73
TOTALS	61 50	31 76	1 33	49 73	144 72
	93 miles 46 chains.		51 miles 26 chains.		

Thus, in the "Northern and Eastern Section," there are at present 93½ miles of tramway in operation, of which 62 miles are worked by horses and 31½ miles by electricity. A further length of 51¼ miles has been authorised, and numerous extensions are proposed. (*See* Table No. 58 in the Appendix). *Table No. 58*

"Southern Section."

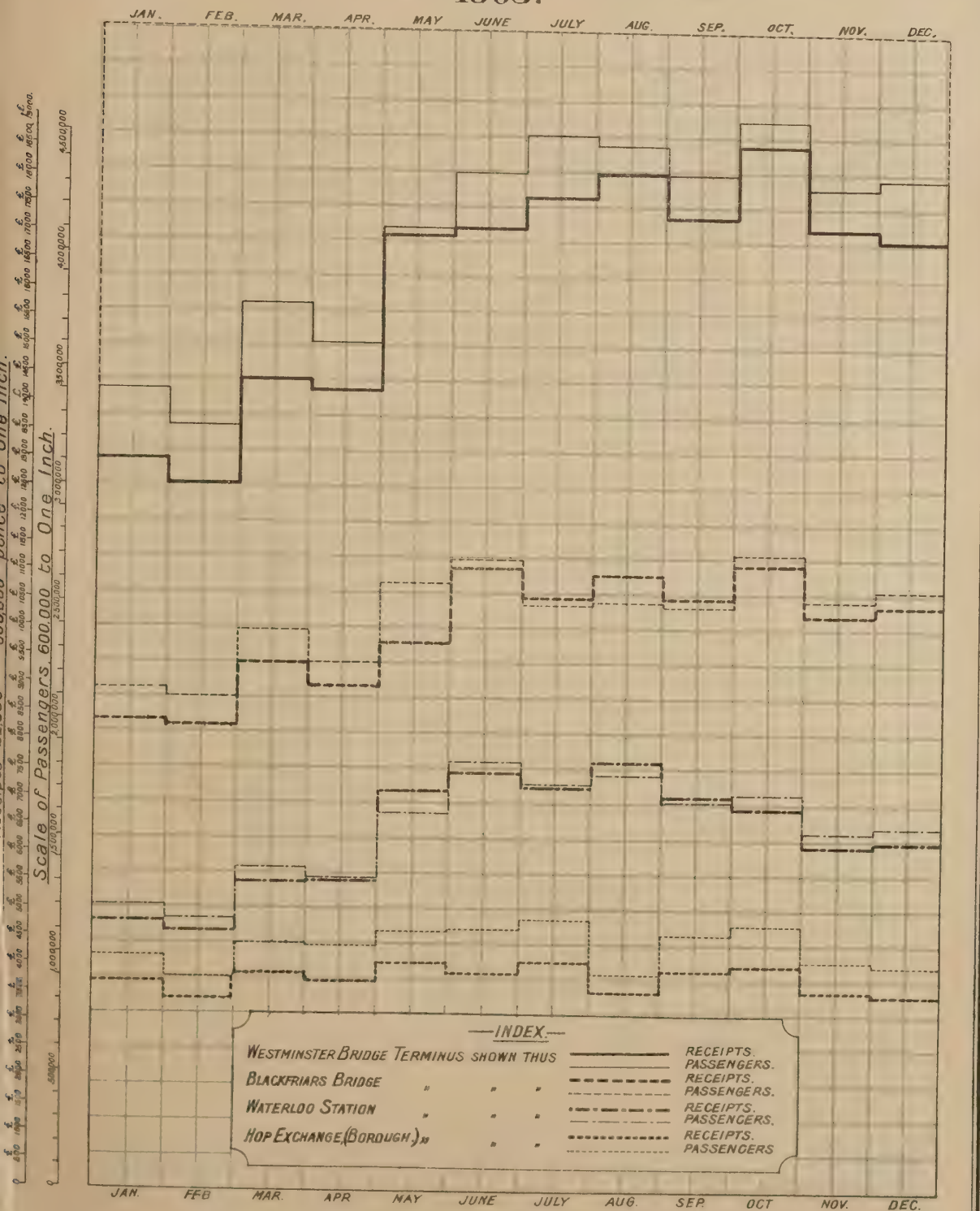
(2) The "Southern Section" lies entirely to the south of the Thames (with the exception of a short line along the Vauxhall Bridge Road to Victoria Station) with its inward termini on the approaches to the various bridges crossing the Thames. It covers the districts between Clapham Junction to the west, Lower Tooting and Streatham to the south, Deptford and Greenwich to the south-east, and Woolwich and Plumstead to the east. There are 60[1] miles of line within the County of London boundary, of which 49[1] miles are at present owned and worked by the London County Council. (These lines are shown in blue on Plan No. 9.) The remaining 11 miles are in the hands of private companies, but will no doubt be purchased by the London County Council in the course of a few years. In addition some further 19 miles have been authorised to be constructed by the London County Council. Beyond the limits of the Administrative County of London there are the Croydon Corporation Tramways and the Croydon and District Tramways (shown in black on Plan No. 9), which are owned by or leased to the British Electric Traction Company, and have a total length of rather over 26 miles, of which about 10 miles are already working. To the eastward there are similar conditions to those north of the river, viz., tramways constructed or about to be constructed, and operated by the several local authorities through whose districts they pass. Over 13 miles *Plan No. 9.* *Plan No. 9.*

[1] Including the London, Camberwell and Dulwich Tramway Company's line, which has been derelict for some years, but was recently purchased by the London County Council.

DIAGRAM No 79.
(See Table No 62.

LONDON COUNTY COUNCIL TRAMWAYS.

DIAGRAM SHOWING MONTHLY VARIATION IN NUMBER OF PASSENGERS CARRIED ON THE ROUTES TERMINATING AT WESTMINSTER BRIDGE, BLACKFRIARS BRIDGE, WATERLOO STATION AND HOP EXCHANGE, (BOROUGH) AND RECEIPTS FOR 1903.



Weller & Graham, Ltd Litho. London

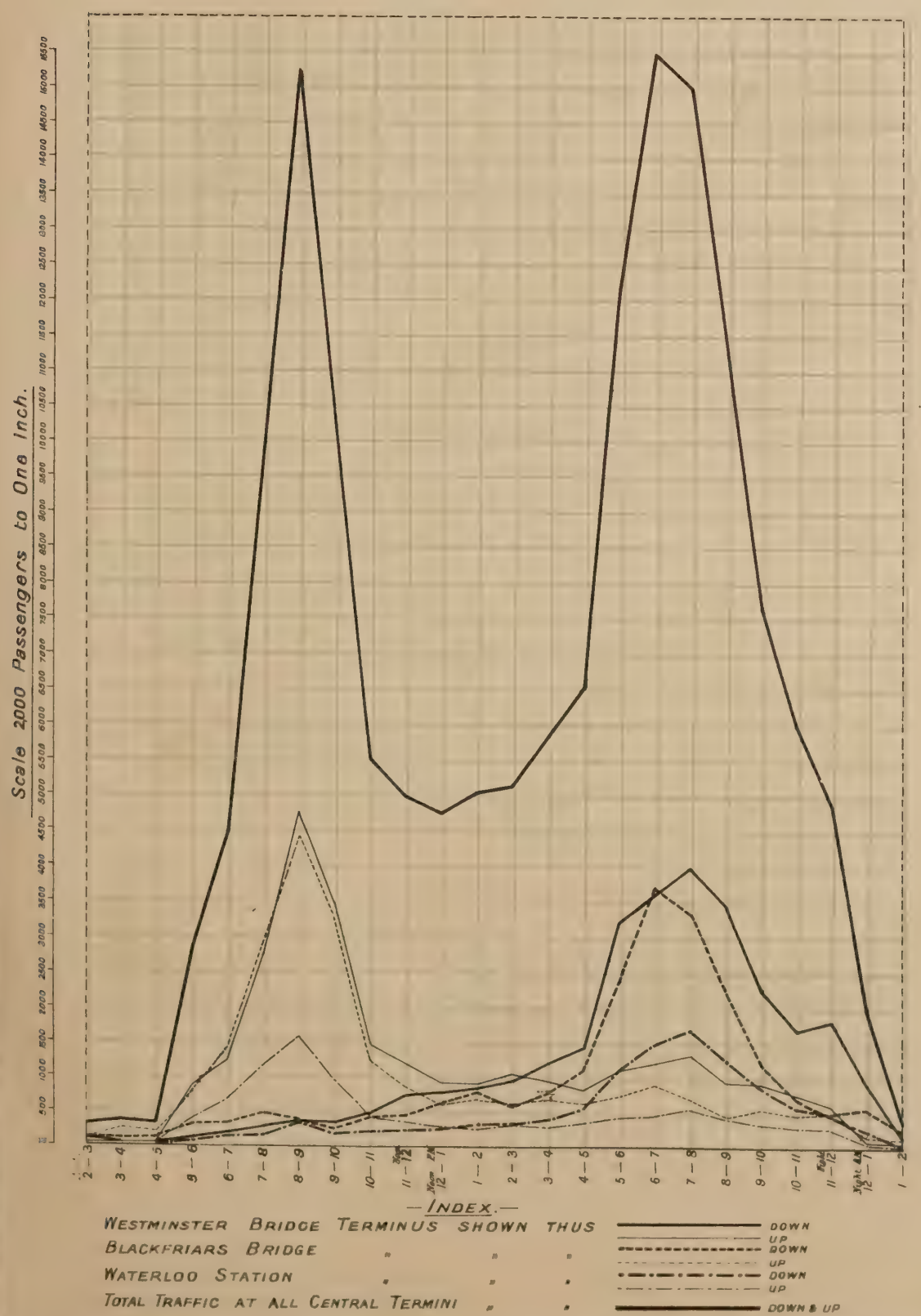
ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

LONDON COUNTY COUNCIL TRAMWAYS.

DIAGRAM SHOWING HOURLY VARIATION IN TERMINAL TRAFFIC AT WESTMINSTER BRIDGE, BLACKFRIARS BRIDGE AND WATERLOO STATION, AND IN TOTAL TRAFFIC AT ALL CENTRAL TERMINI,

ON AN AVERAGE WEEK-DAY (TUESDAY JUNE 21ST 1904.)



Waller & Graham Ltd Litho London

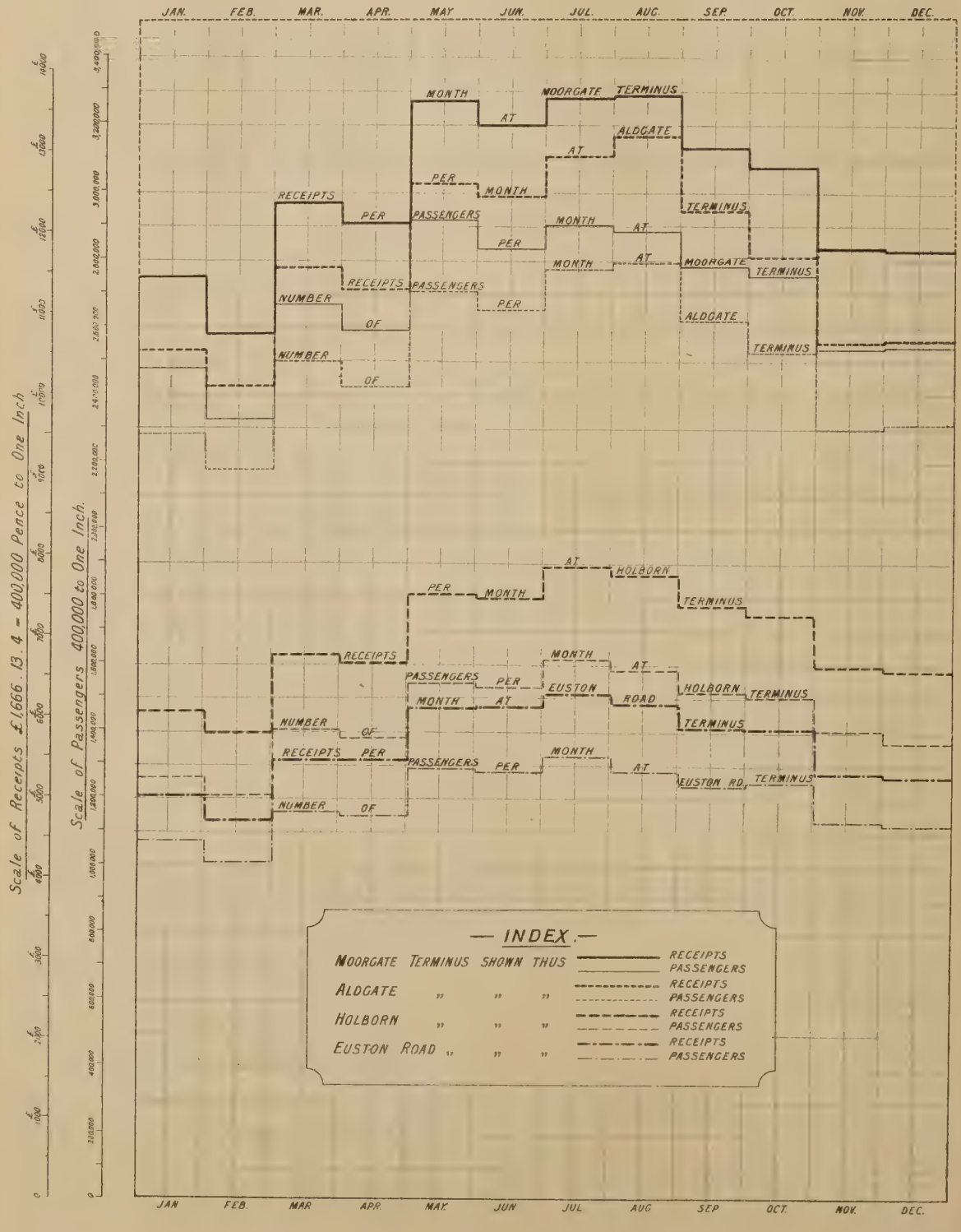
DIAGRAM N° 82
(See Table N° 64)

ROYAL COMMISSION ON LONDON TRAFFIC

REPORT OF ADVISORY BOARD.

LONDON COUNTY COUNCIL TRAMWAYS – NORTH METROPOLITAN SECTION.

DIAGRAM SHOWING MONTHLY VARIATION IN NUMBER OF PASSENGERS CARRIED ON THE ROUTES TERMINATING AT MOORGATE, ALDGATE, HOLBORN AND EUSTON ROAD AND RECEIPTS FOR 1903.



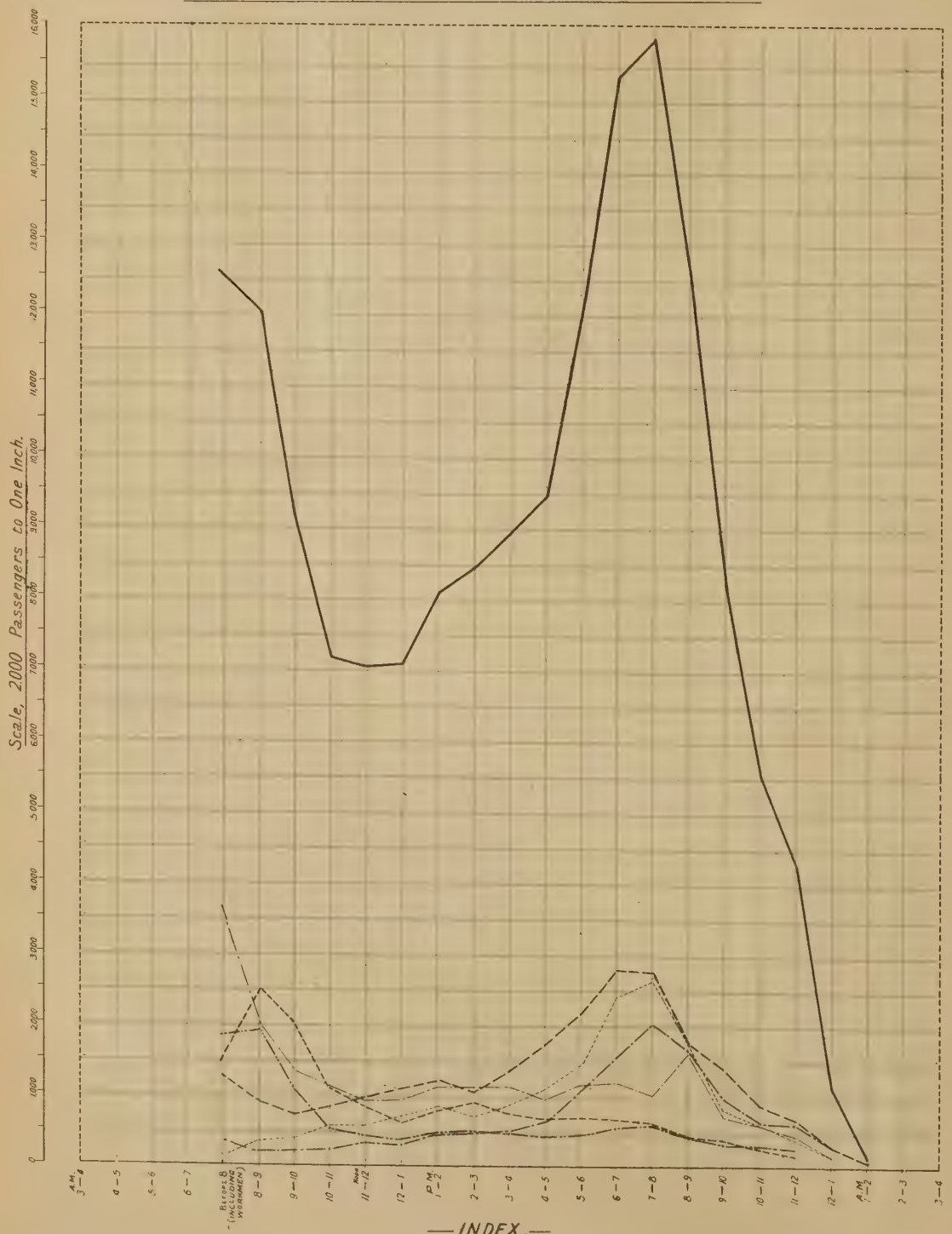
5104 5.05

Weller & Graham. Ltd Litho. Lond

LONDON COUNTY COUNCIL TRAMWAYS — NORTH METROPOLITAN SECTION.

DIAGRAM SHOWING HOURLY VARIATION IN TERMINAL TRAFFIC AT ALDGATE, MOORGATE AND EUSTON ROAD, AND IN TOTAL TRAFFIC AT ALL CENTRAL TERMINI,

On an average Week-day (Monday June 13th 1904.)



— INDEX. —

ALDGATE TERMINUS SHOWN THUS — — — — — DOWN
" — · — · — UP
MOORGATE " · · · · · · · · DOWN
" — — — — — UP
EUSTON ROAD " — — · — — DOWN
" — · — · — UP
TOTAL TRAFFIC AT ALL CENTRAL TERMINI ——— DOWN & UP.

5104 5 05.
Weller & Graham, Ltd Litho, London.

of line are already authorised, of which over five are working, and a much greater mileage is contemplated. (Shown in black on Plan No. 9).

Plan No. 9.

TABLE XLV.

Route Mileage of Tramways and Light Railways (along public roads) wholly or mainly within "Greater London," including all lines authorised during the Parliamentary Session of 1904.

"SOUTHERN SECTION."

Tramway or Light Railway.	Route Mileage.				
	Working.		Authorised, but not in operation.		Total.
	Horse.	Electric.	Horse.	Electric.	
	M. Chs.	M. Chs.	M. Chs.	M. Chs.	M. Chs.
London County Council	14 31	25 23	—	18 61	58 35
London, Deptford and Greenwich	6 34	—	—	—	6 34
London, Camberwell and Dulwich	—	—	2 70	—	2 70
London Southern	5 60	—	—	—	5 60
Woolwich and South East London	4 70	—	—	—	4 70
Mitcham Light Railways	—	—	—	3 12	3 12
Croydon Corporation	—	10 57	—	—	10 57
Croydon and District	—	—	—	16 0	16 0
Beckenham Urban District Council	—	—	—	2 0	2 0
Bexley Urban District Council	—	5 22	—	—	5 22
Erith Urban District Council	—	—	—	8 8	8 8
TOTALS	31 35	41 22	2 70	48 1	123 48
	72 miles 57 chains.		50 miles 71 chains.		

To sum up, there are in the "Southern Section" already about $72\frac{3}{4}$ miles of tramway in operation, $31\frac{1}{2}$ miles by horses and $41\frac{1}{4}$ miles electrically, while 51 miles in addition are already authorised. (*See* Table No. 58 in the Appendix).

Table No. 58.

(3) The "Western Section" comprises the London United Tramway Company's lines (shown in green on Plan No. 9), through Ealing to Uxbridge, and to Kew, Richmond, and Hampton Court.

"Western Section."

Plan No. 9.

TABLE XLVI.

Route Mileage of Tramways and Light Railways (along public roads) wholly or mainly within "Greater London," including all lines authorised during the Parliamentary Session of 1904.

"WESTERN SECTION."

Tramway or Light Railway.	Route Mileage.				
	Working.		Authorised, but not in operation.		Total.
	Horse.	Electric.	Horse.	Electric.	
	M. Chs.	M. Chs.	M. Chs.	M. Chs.	M. Chs.
London United	1 51	35 32	—	44 51	81 54
TOTAL	1 51	35 32	—	44 51	81 54
	37 miles 3 chains.				

Thirty-seven miles are already working, and 45 miles more are authorised, making 82 miles in all. The whole of the lines in operation are worked electrically, with the exception of about one and a half miles

between Kew Bridge and Richmond, on which horses are used. (*See* Table No. 58 in the Appendix). *Table No. 58.*

Total mileage

Summing up there are in the three sections 203¼ miles of lines in operation, 146¾ miles of lines authorised but not yet built, making a total of 350 miles.

TABLE XLVII.

Summary of Route Mileage of Tramways and Light Railways (along public roads) wholly or mainly within "Greater London," including all lines authorised during the Parliamentary Session of 1904.

Section.	Route Mileage.				
	Working.		Authorised, but not in operation.		Total.
	Horse.	Electric.	Horse.	Electric.	
	M. Chs.	M. Chs.	M. Chs.	M. Chs.	M. Chs.
"Northern and Eastern"	61 50	31 76	1 33	49 73	144 72
"Southern"	31 35	41 22	2 70	48 1	123 48
"Western"	1 51	35 32	—	44 51	81 54
GRAND TOTALS	94 56	108 50	4 23	142 45	350 14
	203 miles 26 chains.		146 miles 68 chains.		

A detailed statement of the mileage of all lines wholly or mainly within "Greater London" at June 30th, 1904, is given in Tables Nos. 58, 59, 60, and 61 in the Appendix, with particulars of the number of passengers carried, receipts, &c. *Tables Nos. 58, 59, 60, and 61.*

Tables and diagrams relating to tramways.

Particulars of the London County Council Tramways south of the Thames will be found in Diagram No. 78 in the Appendix, giving: (1) The daily variation in the number of passengers carried and receipts for 1903, (2) The average variation due to the day of the week, (3) The hourly variation in number of passengers carried and receipts taken over the whole system on a fine week-day, not a Saturday. Table No. 62 in Appendix shows the monthly variation in the number of passengers carried on the routes terminating at Westminster Bridge, Blackfriars Bridge, Waterloo Station, and Hop Exchange (Borough), and receipts for 1903. Diagram No. 79, facing page 72, illustrates Table No. 62; and Table No. 63 in the Appendix shows the hourly variation in terminal traffic at Westminster Bridge, Blackfriars Bridge, Waterloo Station, and in the total traffic at all central termini. Diagram No. 80, facing page 72, illustrates Table No. 63. *Diagram No. 78.* *Table No. 62.* Diagram No. 79. *Table No. 63.* Diagram No. 80.

Particulars of the North Metropolitan Section of the London County Council Tramways will be found in Diagram No. 81 in the Appendix, similar to Diagram No. 78, for the London County Council Tramways south of the Thames. Table No. 64 in the Appendix shows the monthly variation in the number of passengers carried on the routes terminating at Moorgate, Aldgate, Holborn, and Euston Road, and receipts for 1903. Diagram No. 82, facing page 73, illustrates Table No. 64; and Table No. 63 in the Appendix shows the hourly variation in terminal traffic at Aldgate, Moorgate, and Euston Road, and in total traffic at all central termini. Diagram No. 83, facing page 73, illustrates Table No. 63. *Diagram No. 81.* *Table No. 64.* Diagram No. 82. Diagram No. 83.

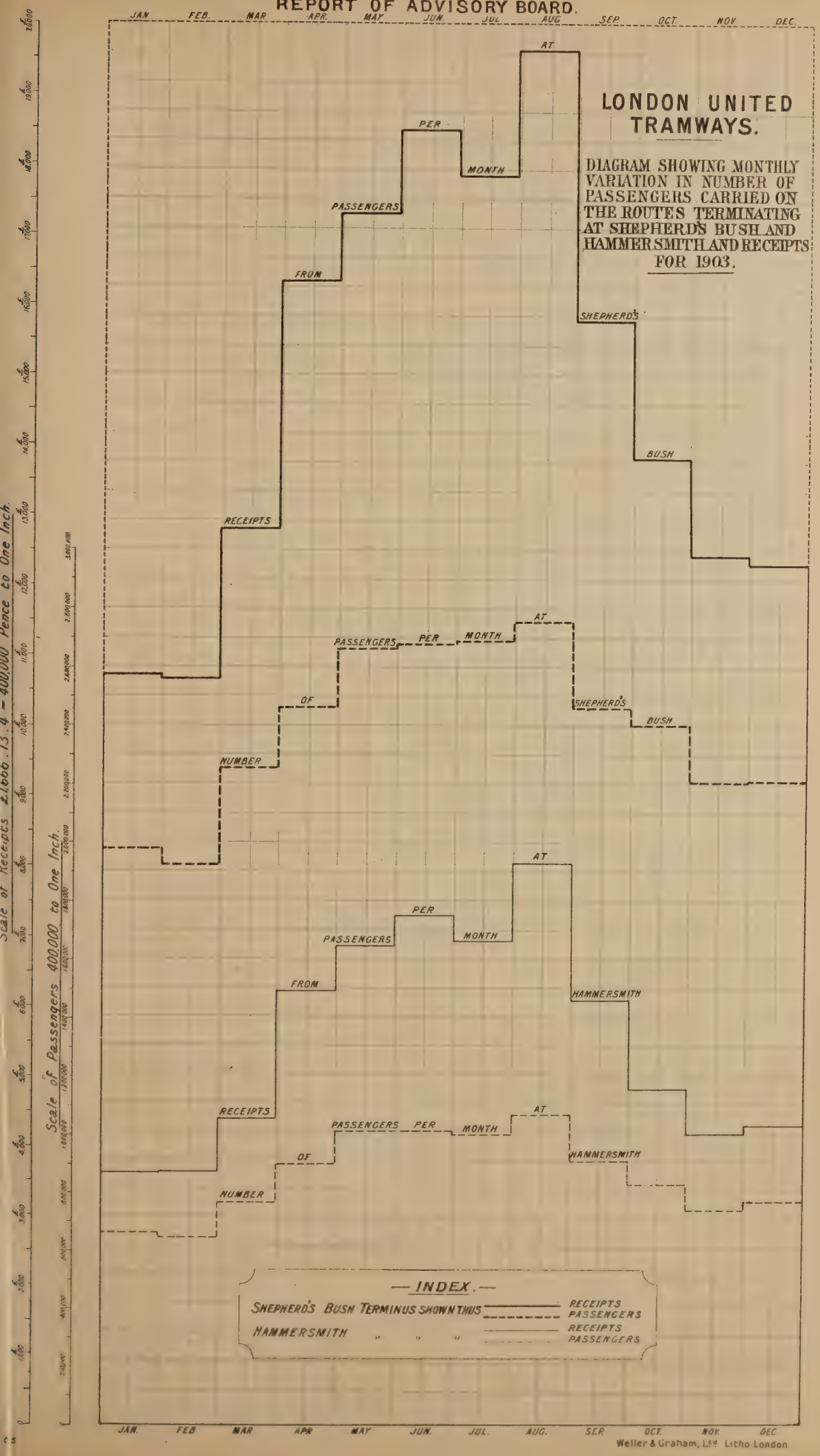
Particulars of the London United Tramways will be found in Diagram No. 84 in the Appendix, which is similar to Diagrams No. 78 and No. 81 for the London County Council Tramways. Table No. 65 in the Appendix shows the monthly variation in the number of passengers carried on the routes terminating at Shepherd's Bush and Hammersmith, and receipts for 1903. Diagram No. 85, facing this page, illustrates Table No. 65, and Table No. 63 in the Appendix shows the hourly variation in terminal traffic at Shepherd's Bush and Hammersmith, and in total traffic. Diagram No. 86, facing this page, illustrates Table No. 63. *Diagram No. 84.* *Table No. 65.* Diagram No. 85, facing. Diagram No. 86.

DIAGRAM Nº85.

ROYAL COMMISSION ON LONDON TRAFFIC

(See Table Nº65)

REPORT OF ADVISORY BOARD.


JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
LONDON UNITED TRAMWAYS.
DIAGRAM SHOWING MONTHLY VARIATION IN NUMBER OF PASSENGERS CARRIED ON THE ROUTES TERMINATING AT SHEPHERD'S BUSH AND HAMMERSMITH AND RECEIPTS FOR 1903.
RECEIPTS FROM PASSENGERS PER MONTH AT SHEPHERD'S BUSH
NUMBER OF PASSENGERS PER MONTH AT SHEPHERD'S BUSH
RECEIPTS FROM PASSENGERS PER MONTH AT HAMMERSMITH
NUMBER OF PASSENGERS PER MONTH AT HAMMERSMITH
Scale of Receipts £1666.13.4 = 400000 Pence to One Inch.
Scale of Passengers 400,000 to One Inch.
INDEX.
SHEPHERD'S BUSH TERMINUS SHOWN THUS RECEIPTS PASSENGERS
HAMMERSMITH " " " RECEIPTS PASSENGERS
JAN. FEB MAR APR MAY JUN. JUL. AUG. SEP OCT. NOV. DEC

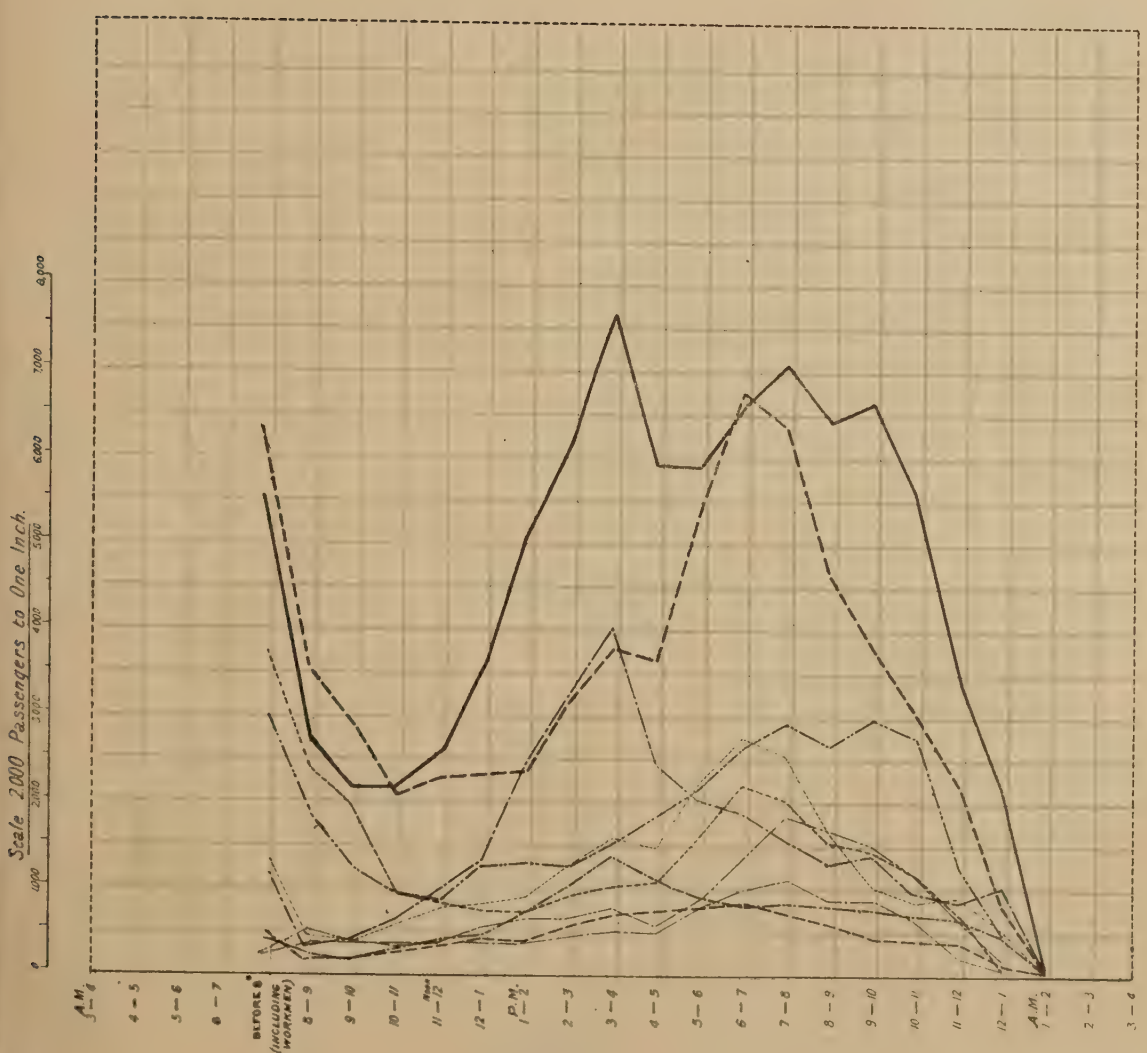
Weller & Graham, Ltd Litho London

DIAGRAM Nº 86.
(See Table Nº 63)

LONDON UNITED TRAMWAYS.

DIAGRAM SHOWING HOURLY VARIATION IN TERMINAL TRAFFIC AT SHEPHERD'S BUSH AND HAMMERSMITH TERMINI, AND TOTAL.

ON AN AVERAGE WEEK-DAY (THURSDAY JUNE 16TH) AND ON A SATURDAY (JUNE 18TH 1904)



— INDEX. —

AVERAGE WEEK DAY. NOT A SATURDAY.

SHEPHERD'S BUSH TERMINUS SHOWN THUS — DOWN, UP
HAMMERSMITH " " " — DOWN, UP
TOTAL TRAFFIC " " " — DOWN & UP.

SATURDAY.

SHEPHERD'S BUSH TERMINUS SHOWN THUS. — DOWN, UP
HAMMERSMITH. " " " — DOWN, UP
TOTAL TRAFFIC " " " — DOWN & UP.

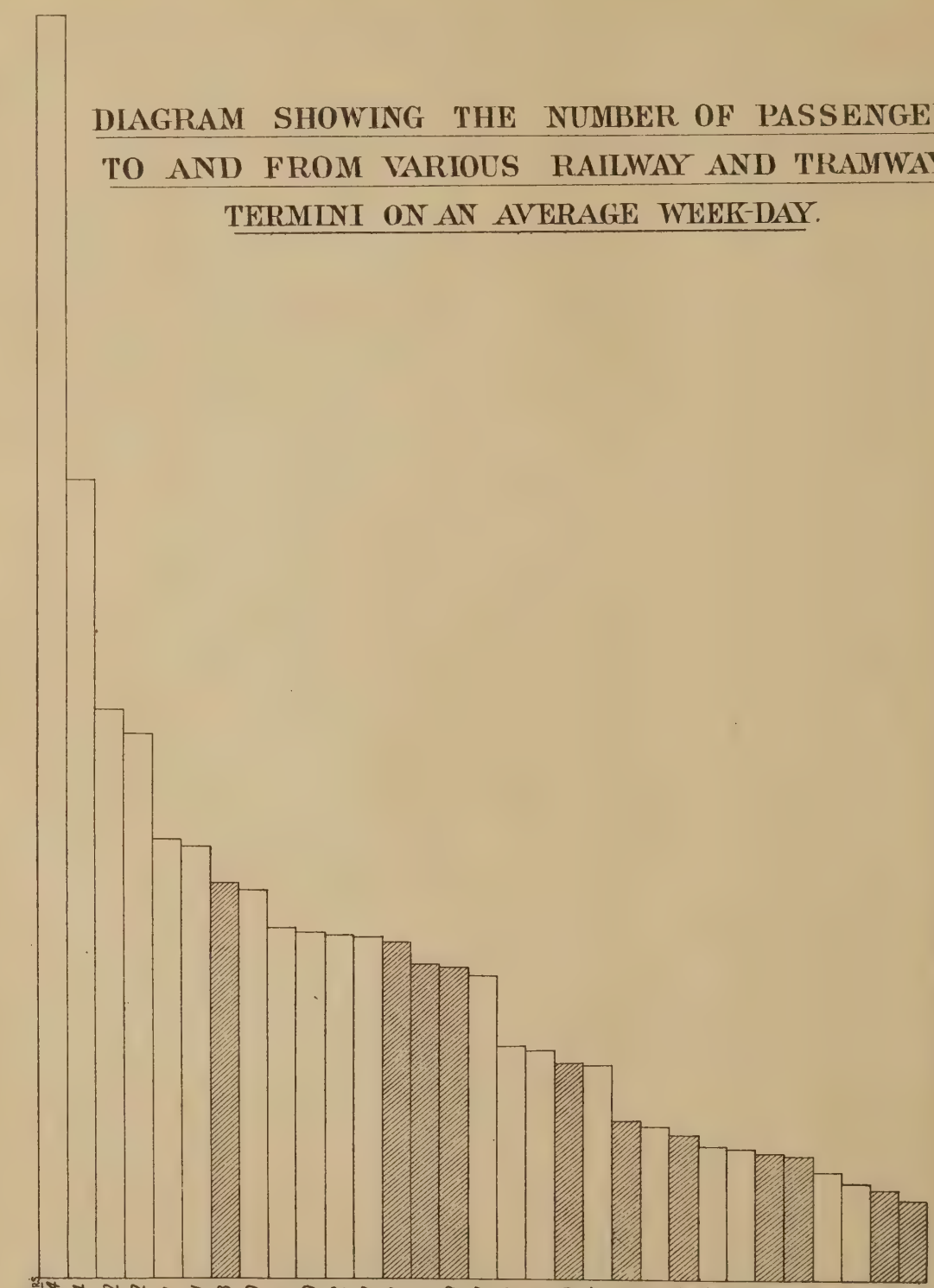
5104. 5 05.
Weller & Graham, Ltd · Litho, London.

DIAGRAM Nº 75.
(See Tables Nos 63 and 67)

ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

DIAGRAM SHOWING THE NUMBER OF PASSENGERS TO AND FROM VARIOUS RAILWAY AND TRAMWAY TERMINI ON AN AVERAGE WEEK-DAY.



TERMINUS.	OWNER	Nº OF PASSENGERS
Liverpool Street	G.E.	176,754
Waterloo	L&S.W.	112,024
Broad Street	N.L.	79,822
London Bridge	L.B&S.C.	76,702
Fenchurch Street	G.E. and L.T&S.	61,961
Cannon Street	S.E&C.	60,491
Westminster Bridge	L.C.C.	55,353
Charing Cross	S.E&C.	54,830
Victoria	S.E&C.	49,651
Kings Cross & York Road	G.N.	48,900
Victoria	L.B&S.C.	48,332
Baker Street	Met. Extn.	48,057
Shepherd's Bush	L.U	47,052
Blackfriars Bridge	L.C.C.	44,281
Aldgate	L.C.C-N.M.	44,158
Paddington & Bishop's Road	G.W.	42,967
London Bridge	S.E&C.	33,339
Ludgate Hill	S.E&C.	32,381
Moorgate	L.C.C-N.M.	30,509
St Paul's	S.E&C.	30,167
Euston Road	L.C.C-N.M	22,751
Holborn Viaduct	SE&C.	21,418
Waterloo Station	L.C.C.	20,520
Vauxhall	L&S.W.	18,895
Euston	L&N.W.	18,540
Hammersmith	L.U.	17,935
Holborn	L.C.C-N.M.	17,615
St Pancras	Mid.	15,045
Addison Road	W.L. and W.L.J.	13,359
Vauxhall Station	L.C.C & L.S.	12,232
Bloomsbury	L.C.C-N.M	11,224

Note. Tramway Passenger Traffic shown Hatched.

5104 5.05

Weller & Graham, Ltd Litho, London

The three sections into which the tramway system of London is divided are not in any way connected with each other, so that it is not possible for a person residing in one of them to travel to the districts served by the systems of another section. Thus, so far as public convenience is concerned, the tramway systems of each section might almost be situated in different cities. Further, it may be pointed out that no single tramway route either traverses or penetrates the City of London, the "West End" shopping district, or the districts containing the theatres and places of public resort; that is, no portion of "Greater London" is directly connected by tramways with those neighbourhoods from and to which the great ebb and flow of the human tide takes place daily. These districts, towards which the major portion of the traffic of London is directed, are hereafter referred to as "points of destination."

The three "tramway sections" unconnected.

"Greater London" unconnected.

"Points of destination."

On studying this phase of the question in detail, it is found that no tramway of the "Southern Section" crosses the river Thames, which acts as a barrier in shutting off south London, and the cars stop abruptly at termini in the middle of the roadways. In like manner passengers in the "Northern and Eastern Section" are carried to termini situated at the boundary of the City of London, where they are compelled to alight at the outer edge of the district into which they are desirous of being carried. This fact probably accounts for the ability of horse omnibuses, as such, to compete with the tramcars on the same routes.

No tramways cross the Thames.

The tramways of the "Western Section" are somewhat better off in that they have the Central London Railway, and the Metropolitan District and Metropolitan Railways to carry their passengers eastward; but the lines in that Section, like the lines in the "Southern," and "Northern and Eastern" Sections, are compelled to discharge their passengers at dead-end termini and at places short of the actual "points of destination."

"Western Section" tramways and Central London Railway.

Dead-end termini.

The necessary result of such methods of operation is that, on an average day, the number of passengers alighting from or joining the cars at the following street termini reach the figures stated in Table XLVIII.:—

Number of passengers using tramway termini.

TABLE XLVIII.

NUMBER OF PASSENGERS ALIGHTING FROM AND JOINING TRAMWAY CARS AT THE FOLLOWING STREET TERMINI.

Termini.	Up Passengers.	Down Passengers.	Total Passengers.
Westminster Bridge	26,942	28,411	55,353
Shepherd's Bush	25,074	21,978	47,052
Blackfriars Bridge	22,760	21,521	44,281
Aldgate	20,747	23,411	44,158
Moorgate	14,468	16,041	30,509
Euston Road	10,655	12,096	22,751
TOTALS	120,646	123,458	244,104
Waterloo Station	9,750	10,770	20,520
Hammersmith	9,661	8,274	17,935
Holborn	8,097	9,518	17,615
Vauxhall Station	5,690	6,542	12,232
Bloomsbury	5,487	5,737	11,224
GRAND TOTALS	159,331	164,299	323,630

Six terminal points considered.

In short, at the first six terminal points given in the above table, there are daily handled nearly one quarter of a million passengers, and all the tramway termini are in the middle of the roadways. In order to fix a standard with which these figures may be compared, so that their full meaning can be appreciated, it may be pointed out that, from the results of counts made under our direction (*see* Table No. 61 in the Appendix), the total number of passengers at the first-mentioned six points alone is as great as the daily aggregate of passengers arriving at, and departing from, the great railway stations at Paddington and Bishop's Road, Euston, St. Pancras, King's Cross and York Road, Fenchurch Street, and Charing Cross (*see* Table No. 67 in the Appendix), while the tramway traffic handled at Westminster Bridge alone exceeds the total traffic at any one of the above-mentioned stations, except Fenchurch Street. As another illustration, the Westminster Bridge tramway traffic exceeds by nearly 10 per cent. the aggregate traffic of the five stations on the Metropolitan District Railway from Aldgate East to Blackfriars, both inclusive (*see* Table No. 69 in the Appendix), and is only surpassed by the traffic at six of the great railway termini, as will be seen on Diagram No. 75 facing page 75, which shows the number of passengers to and from various tramway and railway termini on an average day.

Table No. 61.

Table No. 67.

Table No. 69.

Diagram No. 75.

Relative importance of tramway and railway termini.

The relative importance of tramway and railway termini in London thus becomes at once apparent, and it will be seen that it is quite as desirable for the convenience of traffic in respect of the former as well as of the latter to furnish proper facilities. This has not up to the present time been generally recognised.

Total traffic by public conveyance in London and other cities.

The total traffic by public conveyances in London has been shown in the introductory pages of this report to amount annually to about 1,164,000,000 passenger journeys, or an average of 170 per head of the population. This figure is inferior to that of other cities. In Paris, the per capita journeys are 200, in Berlin 270, and in New York 300, as, illustrated by Diagram No. 76, facing this page.

Diagram No. 76, facing.

London has lowest average.

So low an average as that in London means that insufficient accommodation or facilities are provided, and that people either do not travel or else go on foot, in all cases at personal and industrial loss. The argument is frequently used that London should not be judged by other standards, but must be considered as a city quite *sui generis*. This argument may be fallacious. The chief difference in standards is that London, being larger than other cities, with a greater traffic and a greater business, and covering a larger area in proportion to population, on account of its low buildings and its frequent parks, requires more complete travelling facilities.

Isolation of the three sections as shown on Plan No. 9 and Diagram No. 77.

Attention is invited to Plan No. 9 attached to page 89 and the Key Plan thereto facing page 88 of this report, upon which the tramway lines now existing in London or authorised are laid down. A brief inspection will show the three separate sections into which the various systems are geographically divided, as referred to previously, and the isolation of these sections becomes at once apparent. This may be seen still more graphically by turning to Diagram No. 77 in the Appendix, kindly furnished to us by Mr. Harper, the Statistical Officer of the London County Council, on which is indicated in blue, not only the termini in the "Central Area," but those in the suburbs; the ordinary tramway routes; the routes or portion of routes on which a workman's or early morning service of cars only is run; the routes or portion of routes on which a service of cars is run only during certain hours in the morning or evening or both; and the number in red figures of cars per hour in both directions during hours of full service.

Plan No. 9. Key Plan.

Diagram No. 77.

Failure of tramways to reach "points of destination."

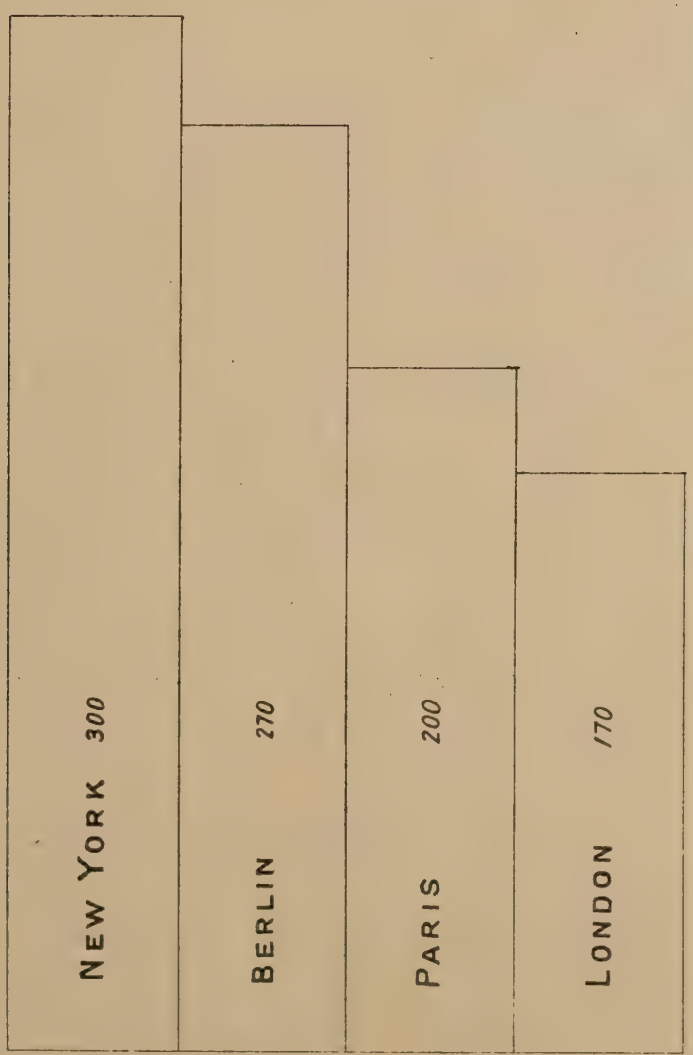
The failure of the lines of any of the constituent systems to reach "points of destination" and the abrupt termination of every line, necessitates the return shunting of the cars.

Defects of the general tramway system of London.

Such are the defects of the general tramway system of London, and so great are they that it is extraordinary that the tramways are able to furnish a public service equal to carrying 405,000,000 passengers per annum. This figure, however, can be taken as some indication of the service and benefit which a system of tramways, properly laid out and operated, would

ROYAL COMMISSION ON LONDON TRAFFIC.
REPORT OF ADVISORY BOARD.

DIAGRAM SHOWING PER CAPITA JOURNEYS BY PUBLIC CONVEYANCES BY INHABITANTS OF VARIOUS TOWNS DURING ONE YEAR



Weller & Graham, Ltd Litho London.

confer on the inhabitants of the Administrative County of London and the surrounding districts.

Briefly recapitulated, the defects of the London tramways are :— Defects of the London tramway system.

1. Insufficient mileage ;
2. The stopping of existing lines short of " points of destination " ;
3. Dead-end terminals, setting up points of congestion in the streets.

Reference has already been made to the last, to which prominence was given, because it is the only one of the three of which the inconvenience and extent can be shown by figures. In respect of the great numbers of passengers alighting from and joining the tramcars at the first six terminal points already referred to, and of the less, but still great, number at the other terminal points also given in Table XLVIII., it must be remembered that these points constitute the destination of but a very small percentage of such passengers. By far the greater number of passengers unwillingly alight because the tramcars go no further, and similarly the same persons are forced to return to these points because the tramcars approach no nearer to the point of commencement of such return journeys. This forced alighting causes great congestion in the roadways where the tramcars stop and much crowding of the streets leading to the terminal points. Tramways stop short of " points of destination." Table XLVIII. Inconvenience to passengers.

Comparison has been made with the main-line railway termini. The same general argument against dead-end terminals applies to the main-line railway stations, but in that case, owing to the necessity of arranging for the proper handling of luggage and the conduct of the business of long-distance trains, great terminal stations appear for that class of traffic, at least, to be almost essential, though the remark does not apply to suburban traffic. Between main-line railway and tramway termini there is little analogy except in number of passengers. While in the one case a terminal station may be more or less necessary ; in the other it decidedly is not. Railway termini.

No tramway car should end its run while fully loaded, but should continue its journey until at least the greater part of its load has been deposited. This ensures distribution and avoids concentration and street congestion. When the journey of the car is ended an effort should be made, unless the district reached has little other vehicular traffic, and the stopping points are scattered, either to return the car by another route, or to reverse it in direction by a loop, so that in either case shunting may be rendered unnecessary. No tramway car should end its journey while fully loaded.

Cross-shunting of cars, especially in a busy street, seriously limits the capacity of a tramway line, for the number of cars that can be despatched from a dead-end terminus is much less than can be run continuously on the line itself. If there be no terminal points, and the line be made continuous, the capacity of all parts of the line is the same. The same will be found true in regard to suburban or urban railways. Capacity of tramways or railways limited by cross-shunting of cars at dead-end termini.

With the present arrangements, the greatest number of cars received into and returned out of any tramway terminus in London is 100 per hour, which is done under pressure on Bank Holidays only. As several lines converge into each terminus, the number of 100 cars per hour marks the limit of cars which it is possible to run on the contributory lines as a whole, but, owing to the convergence, the cars per hour run on each line must, of course, be much less numerous. In consequence, as an instance, at the two termini at Westminster Bridge, the cars actually run per hour in each direction on the routes terminating there are as follows :—

TABLE XLIX.

NUMBER OF TRAMWAY CARS RUN PER HOUR TO AND FROM WESTMINSTER BRIDGE.

Route.		Cars per hour in one Direction. 8 till 9 a.m.	Cars per hour in one Direction. 9 till 10 a.m.	Cars per hour in one Direction. 6 till 7 p.m.	Number of Cars in one Direction. Whole day.
From :—					
Greenwich (*via* Old Kent Road)	Electric.	14	13	12	164
New Cross Gate (*via* Camberwell Green)	Electric.	20	20	20	257
Camberwell Green (*via* Kennington)	Electric.	10	10	10	155
Streatham	Electric.	10	10	10	172
Tooting	Electric.	18	16	15	208
Totals in one Direction		72	69	67	956
Wandsworth (East Hill)	Horse.	12	12	12	621
Wandsworth (North Street)	Horse.	6	6	6	99
Totals in one Direction		18	18	18	261
Grand Totals in one Direction		90	87	85	1,217

Number of cars dealt with exceedingly small.

The numbers are exceedingly small, but no material increase is possible with the present terminal arrangements. In the absence of terminal delays, it is quite feasible to run 100 cars per hour, or with care 150 or more one way on a single track, even in very busy thoroughfares. From the information collected by the Members of the Royal Commission who visited the United States we see that a service of 150 cars per track per hour is frequently attained, and that more than 200 cars per track per hour are run on Broadway in New York in spite of the other heavy vehicular traffic using that thoroughfare.

Number of cars dealt with in New York.

Cost of tramways in London.

It has been shown in the evidence (*see* Mr. J. W. Benn's evidence given before the Royal Commission) that the cost of tramways (double lines) in London varies from £39,512 for overhead wire construction to £52,602 for conduit construction. With the existing termini the capacity of these lines is reduced to about one-half of what it might be. At the cost, therefore, of improved termini, or their elimination, whereby the carrying capacity of the contributory lines would be increased, it is obvious that a corresponding increase in the return on the capital cost would at once arise. The present tramway lines in London must represent a capital value of not less than £7,500,000, and, whatever will conduce to the greater capacity of the lines, will, in like proportion, increase the value of such capital expenditure, which, in the case of the Administrative County of London, represents, for the most part, the investment of public funds. Such an increase in capital value is not a theoretical assumption, which would be the case if the present lines were carrying all the traffic that could come to them, but is a practical reality, for, with improved termini, and the extension of the present lines to the real "points of destination," traffic will undoubtedly be found to increase. Such is the invariable rule in all cities, illustrations of which will be given later. We have shown the number of passengers inconvenienced by the present terminal arrangements, and the last figures indicate the important effect which improvements would have on the capital value of the tramways.

Existing termini of tramways seriously reduce capacity of lines.

Remedy for the three fundamental deficiencies in London tramways

The three fundamental deficiencies in London tramways are in fact all subject to removal or radical improvement by the same remedial measure, viz., by proper extensions. With such extensions, mileage will be increased,

existing lines carried to "points of destination," and dead-end termini removed.

Tramways on the "Main Avenues."

We have suggested the construction of two "Main Avenues," one east and west, the other north and south. On the surface thereof there should be laid, at least, four lines of surface tramways, two of which would be reserved, as far as possible, for through running, the transverse lines crossing and not joining. Such a line on the east and west "Avenue" would carry cars from the "Western Section" to the "Eastern Section" and *vice versa*, while the north and south "Avenue" will carry cars between the "Northern" and "Southern" Sections, and the termini would be at a considerable distance outside the "Central Area."

Tramway facilities should not wait for construction of "Main Avenues."

Plan No. 9.

The "Main Avenues" proposed would greatly improve the situation with regard to tramways by giving through access to the busiest parts of the City from all parts of the Suburbs (marked Routes Nos. 24 and 25 in red on Plan No. 9), but these "Avenues," being extensive and costly, will require a long time for realisation. By that date the additional facilities afforded may not more than suffice to provide for the normal increase in traffic. In the meantime, it is necessary to take steps for meeting present needs by constructing lines of tramways, not merely for supplementing those suggested on the "Avenues," but as being in themselves immediately wanted.

The extensions and improvements most urgently required to remedy the deficiencies in London's system of tramways and to provide the public with reasonable accommodation are :—

Extensions and improvements most urgently required.

1. That the lines south of the Thames should be extended across the river. To this end the tramway lines should be carried across Hammersmith, Putney, Albert, Victoria, Vauxhall, Westminster, Blackfriars, and Southwark Bridges, these structures to be widened and strengthened or rebuilt where necessary. In addition to these connections, lines should be carried across the river over the new bridge suggested as part of the north and south "Main Avenue," and a connection should be carried beneath the river east of the Tower Bridge; reference to which will be made below.

2. The lines described above should be further extended so as to reach "points of destination" and avoid terminals. Some of these extensions will serve to cross-connect the "Northern and Eastern" and "Southern" Sections.

3. The joining of the terminals of the "Northern Section" where the same are not extended through, as proposed in 2, so as to remove places of congestion, and permit of continuous running with an increased number of cars.

4. The construction of lines in the south-west district between Putney, Hammersmith, Victoria, and Knightsbridge, possibly combined with the subway to Aldgate referred to on page 80.

5. Tramway extension to all the great railway terminal stations.

6. General and unrestricted facilities of through communication, so that cars with their passengers from outlying districts can pass through to the commercial centres over systems or portions of systems, and *vice versa*, irrespective of ownership.

Recommendations are only general, given as examples.

Within the limits of this report and our functions as an Advisory Board, these recommendations can be considered only on general lines. In the following discussion, certain streets and definite routes are mentioned. It must be understood, however, that, except in the specific cases where no alteration is feasible, the mention of definite routes, and the red lines shown on Plan No. 9 and on the Key Plan, are to be considered as only tentative, and as made, not so much to fix the position, as to give a clearer idea of the particular districts to be served, and the approximate route which should be followed. If the general scheme be adopted, the detailed studies then to be made may, and probably will, bring to light local variations and improvements, by which the same results may be obtained, but by a method better in detail.

Junctions should be avoided and traffic resolved into two components.

There is one local consideration of the subject which ought to be borne in mind. While it is desirable that cars should, not only run through, but also pass from the north and south to the east and west routes, such an arrangement is not always possible, and, as traffic increases, it becomes less

feasible. Fewer cars can be handled at a junction than at a crossing. Of the latter there are known instances in the United States where over 200 cars per hour on each double track are running over a crossing of two double track lines in the streets at right angles with other heavy vehicular traffic, and where 240 cars each hour cross 250 cars on an angle of 30 degrees, and 240 more cars cross the same spot at right angles to one of the lines, making 730 cars per hour, with a large number of other vehicles besides. To handle such a number at a junction would be exceedingly difficult, if not impossible. It will, as a rule, therefore, be better to resolve the traffic into two components, and preserve through running in both directions by carrying each line of each system across all the lines of the other system. This permits the running of the greatest number of cars with less interference to other traffic, and, by a simple change of car on the part of the passenger at crossing points, combined with through booking, the best facilities would be given for reaching all parts of London.

Tramways should pass the stations of the underground railways.

On the same principle the tramway lines should pass, wherever possible, the stations of the underground railways. By thus bringing tramways to the underground railways, passengers, desiring to travel more than a short distance, can readily avail themselves of a faster mode of conveyance. Such freedom of interchange is now almost entirely lacking in London, but the single instance at Shepherd's Bush, where passengers change from tramway to "tube," and *vice versa*, well illustrates the desirability of the interchange. As many such points of connection as possible should be arranged, with the greatest convenience that the local situation in each case will permit.

Hammersmith Bridge.

To develop the general programme outlined above, beginning at the west, the tramway lines should be carried over Hammersmith Bridge (marked Route No. 1 in red on Plan No. 9), joining up the authorised lines on the north and south of the river. From the north end of Hammersmith Bridge an authorised line passes the Hammersmith Broadway Station of the Metropolitan District Railway and the Shepherd's Bush Station of the Central London Railway, so that passengers from the south-west can be given, with but one change of cars, means of reaching the City and "West-End." The construction of Route No. 1 would do away with the authorised dead-end terminals at Hammersmith Bridge. The line already authorised from Hammersmith Broadway to the south side of Putney Bridge should be carried out. On the south side of the river such lines can be extended readily and economically (though some widenings of suburban streets may be necessary) to tap existing lines or reach districts not now served. Plan No. 9.

Hammersmith to Aldgate.

The evidence taken by the Royal Commission would seem to show that the most generally demanded additional facilities are a new line from Hammersmith extending through the chief residential shopping and commercial districts to the eastern limits of the City at Aldgate. In the general view expressed, that this route, marked Routes Nos. 2 and 3 in red on Plan No. 9 (also *see* Plan No. 10 facing this page), is the one most lacking in rapid means of communication, we concur. Over a large part of this area, surface tramways would seem to be out of the question, and additional facilities can therefore be provided only beneath the surface. Such a line would undoubtedly be, especially if constructed in "shallow" subway, extremely costly, and such an expense can be met only by arranging to bring to the system the largest possible amount of traffic, and to furnish such traffic with the greatest possible convenience, such as would be given by a combination of tramway, for short-distance traffic, and "tube" railway, for express service, with "shallow" interchange stations; in these respects fulfilling the same purposes as are accomplished in the new rapid transit railways of New York, some of which have four lines of track, of which two are for express service. Plan No. 10.

We ought, in this connection, to draw attention to the fact that, in addition to the above, the Metropolitan District Company possess Parliamentary powers for a deep-level "tube" under their railway from Earl's Court to the Mansion House. If the authorised deep-level line be carried out, an express railway service could by it be given with one or two interchange

stations connected with the existing stations of the Metropolitan District Railway from Hammersmith to the City.

Fulham and Brompton Roads.

The first condition of bringing to the tramway subway system the largest possible amount of traffic as mentioned above, would be met by building radiating surface tramways in such districts as the streets and street traffic will permit the construction thereof, as, for instance, in the district lying south of Knightsbridge, and extending in a generally south-westerly direction to Putney along, say, the Fulham and Brompton Roads (marked Plan No. 9. Route No. 4 in red on Plan No. 9, also *see* Plan No. 11, facing page 80). Plan No. 11. Other tramways could be constructed at the east end of the suggested underground tramway, taking up tributary traffic from that portion of London lying to the east or north-east of the City. These radiating tramways could either transfer their passengers at convenient points, or the cars could be run into the underground subway and continue through it. The second condition for providing better facilities could be met by adopting the feature of a combined express and local service as was suggested in connection with subways under the new "Main Avenues."

Victoria to Marble Arch.

The authorised line across Vauxhall Bridge would connect, by means of the existing line in Vauxhall Bridge Road, the tramways of the "Southern Section" with the Victoria Stations of the London, Brighton and South Coast Railway and South Eastern and Chatham Railway; and, what is more important, with the Victoria Station on the Metropolitan District Railway, again giving direct access to the City, and all parts served by the "Inner Circle" Railway. This line of tramway could well be extended, Plan No. 9. probably in subway under Grosvenor Place and Hyde Park (marked Route No. 5 in red on Plan No. 9), and thence on the surface up the Edgware Road and Maida Vale (marked Route No. 6 in red on Plan No. 9, *Plan No. 12.* also *see* Plan No. 12 in Appendix), thus reaching the north-west, with a branch passing north of Paddington Station and connecting with the existing tramway on the Harrow Road leading to Kensal Green and Harlesden, and by an authorised extension on to Willesden (marked Route *Plan No. 13.* No. 7 in red on Plan No. 9, also *see* Plan No. 13 in Appendix); and a further branch at Cambridge Avenue near Kilburn Station to connect with the Harrow Road (marked Route No. 8 in red on Plan No. 9, *Plan No. 14.* also *see* Plan No. 14 in Appendix) is desirable. Such routes would not only give a much needed north and south connection, at a part of London where such facilities are lacking, but would pass all the great traffic routes between east and west, reaching stations on the Metropolitan District, the Great Northern, Piccadilly and Brompton, Central London, and Metropolitan Railways, as well as the railway termini at Victoria and Paddington. The tramway now terminating at a dead-end in the Uxbridge Road at Shepherd's Bush could be extended along that thoroughfare and the Bayswater Road to join the above line at the Edgware Road (marked Route Plan No. 9. No. 9 in red on Plan No. 9, also *see* Plan No. 15, facing page 82).

Edgware Road and Maida Vale.

Paddington and Harrow Road.

Cambridge Avenue and Harrow Road.

Shepherd's Bush and Marble Arch.

Plan No. 15. Grave objections have been raised to the crossing of Westminster Bridge by a system of tramways joining the lines of the "Northern and Eastern Section" on the Victoria Embankment at Waterloo Bridge (at which point a "shallow" subway will debouch from beneath Kingsway and the Strand) with the lines of the "Southern Section" in Westminster Bridge Plan No. 9 Road (marked Route No. 10 in red on Plan No. 9). It would be constructively possible to carry the tramways from Kingsway beneath the river to join the "Southern System" in the same way as the cross-connection beneath the river for tramways east of the Tower Bridge is hereafter dealt with (*see* Route No. 16). Such connections are costly, both in structure and in land required for approaches. East of the Tower Bridge no other course is feasible, but even there the expense may cause a postponement of construction until other and more pressing lines are undertaken. At Westminster the extra outlay is not to be recommended, unless, which is not likely, detailed investigation shows that the disadvantages of crossing Westminster Bridge outweigh its obvious recommendations.

Westminster Bridge and Victoria Embankment to Waterloo Bridge.

Existing Westminster Bridge termini.

At the Lambeth end of Westminster Bridge there is found one of the worst situations in London for a tramway terminus. In fact it became so unbearable that a section (67) for preventing obstruction at Westminster

Bridge was inserted in The London County Council (Tramways and Improvements) Act, 1904, which runs as follows: "Whereas it has been "arranged between the Council and the Commissioner of Police that on "and after the first day of January One thousand nine hundred and five "the Council shall not run any cars on that portion of the Tramway "in Westminster Bridge Road which lies to the west of its junction with "York Road on such days and at such hours as the Commissioner of "Police may from time to time direct such arrangement is hereby con-"firmed." As already shown, with the very meagre tramway routes, over 55,000 persons are daily set down and taken up in the centre of the road, and over 1,200 tramway cars are shunted in the public thoroughfares. Of these 55,000 passengers daily, or about 20,000,000 annually, nearly all are obliged to suffer inconvenience and loss of time by crossing Westminster Bridge on foot, and thence seek their destination by the same slow process, or by changing to a slow running omnibus. Now that the lines south of the river leading to Westminster Bridge are being extended and electrified, this great public inconvenience is bound to increase.

Westminster Bridge should, in our opinion, be widened if necessary, the tramway lines carried across it and extended thence along the Victoria Embankment, connecting first with the tramway subway now being built by the London County Council under Kingsway, thus affording a through north and south connection; and secondly with a new line of tramway on Blackfriars Bridge, where it would again make a junction with the southern lines (marked Route No. 11 in red on Plan No. 9).

Blackfriars Bridge and Victoria Embankment to Waterloo Bridge.

Plan No. 9

Great public convenience would be afforded if the line along the Victoria Embankment could be further continued to join the tramway which at present ends at the south side of Southwark Bridge (marked Route No. 12 in red on Plan No. 9). It has been proposed either to widen and improve the gradients of Southwark Bridge (for which an Act of Parliament was unsuccessfully sought last Session), or else to construct an additional bridge west of the present bridge. However this may eventually be settled, it appears to us to be very desirable that, as part of the project, the southern tramways should be carried over the Thames at or near Southwark Bridge, either to join one of the northern lines, to which we draw attention hereafter, or else be turned towards the west to join the suggested tramways at the north end of Blackfriars Bridge, as shown on Plan No. 9, Route No. 12. It is unnecessary to discuss the details of either proposal until the question of a new bridge is decided; but it will be seen that, in both cases, the passengers from the south would be brought into the City by a line which would be free from the disadvantages of a dead-end terminus.

Blackfriars Bridge and Southwark Bridge.

Plan No. 9

Plan No. 9

Extensions would eliminate dead-ends and connect north and south.

The extension of tramways above described would not only eliminate five (there are two at Westminster Bridge and two at Blackfriars Bridge) dead-end termini, but would furnish two or three connections north and south, and provide a good line for local distribution parallel with and close to the Strand, Fleet Street and Ludgate Hill, and land passengers within 350 yards of the Mansion House, besides passing the doors of five stations on the Metropolitan District Railway.

Blackfriars Bridge and Farringdon Street on Viaduct.

At the present tramway termini at the southern end of Blackfriars Bridge 45,000 passengers arrive or depart daily, who, like those at Westminster Bridge, have mostly to cross the former bridge on foot to or from their destinations. When dealing with new streets, we have suggested a widening of Blackfriars Bridge and the carrying of an additional roadway over the Victoria Embankment, New Bridge Street, and Ludgate Circus, coming down to the surface in Farringdon Street. With the level crossing of the Embankment and Ludgate Circus eliminated, advantage could be taken of this upper roadway to carry the tramways from the south of the river to a junction with the existing tramway in Farringdon Street (marked Route No. 13 in red on Plan No. 9), and by a proper diversion, with the one in Gray's Inn Road (marked Route No. 14 in red on Plan No. 9). This would eliminate three terminal points, and cross all the great east and west traffic routes.

Farringdon Road and Gray's Inn Road.

Plan No. 9

New Bridge between Waterloo and Blackfriars.

In addition to these cross-river connections, the proposed new bridge between Waterloo Bridge and Blackfriars Bridge (*see* Route No. 25, page 79) would furnish a means of carrying the tramways terminating in Waterloo

Road across the river, making a through connection and intersecting the east and west traffic lines for purposes of distribution: in the meantime the Waterloo Road tramways should be joined up with the Westminster Bridge Road and Blackfriars Road lines on the south of the river (marked Route No. 15 in red on Plan No. 9, also *see* Plan No. 16 in Appendix).

York Road and Stamford Street.

an No. 9.
an No. 16.

Finally, there remains a connection east of the Tower Bridge. Passengers from Bermondsey, New Cross, or Greenwich are now carried to inconvenient termini at Southwark Bridge or Tooley Street, or, if going more westerly, at Blackfriars or Westminster Bridges. The latter two situations have already been dealt with, and a remedy for the state of things at Southwark Bridge suggested. There remains, however, a much-needed connection for passengers seeking the easterly limits of the City. At present passengers to and from the Bermondsey tramways have to cross the Tower Bridge on foot, with a long walk at the north end, subject to the inconvenience of the bridge being open for vessels. A proper connection could and should be effected by a double subway for tramways only, leading, say, from a convenient point in Bermondsey to the existing dead-end terminus in Leman Street (marked Route No. 16 in red on Plan No. 9).

Connection east of the Tower Bridge.

an No. 9.

So much for the river crossings and their effect on dead-end termini south of the Thames. As to dead-end termini in other localities, there are at present nine in the "Northern and Eastern Section." Under the foregoing recommendations five would be connected and permit of through running. Of the remaining four, beginning at the west, the Hampstead Road line should be extended along Tottenham Court Road, Charing Cross Road and Whitehall (marked Route No. 17 in red on Plan No. 9) to a connection with the tramways crossing Westminster Bridge. The Theobald's Road terminus will be relieved by the extension already contemplated under the Kingsway in the new subway joining the proposed Victoria Embankment lines. The lines now terminating at Moorgate and Norton Folgate should be extended southwards and joined (marked Route No. 18 in red on Plan No. 9, also *see* Plan No. 17 in Appendix), so as to approach as near as possible the "points of ultimate destination" in the City, and to make feasible points of access to the various underground railways reaching other parts of London.

Nine dead-end termini in the "Northern and Eastern Section."

an No. 9.

Tottenham Court Road, Charing Cross Road, and Whitehall.

Moorgate, Liverpool Street, and Norton Folgate.

an No. 17.

At some points on this route the streets are very narrow, but the public benefits of extending the lines leading to these termini so as to be closer to "points of destination" and to reach the Bishopsgate and Moorgate Street stations of the Metropolitan Railway and the great railway termini in Liverpool Street, together with the relief of the street congestion resulting from the present system of shunting cars in the centre of the roadways, would seem to warrant the expense of street widenings, especially as existing vehicular traffic already overcrowds these thoroughfares.

Streets very narrow on Route No. 18.

From the present tramway terminus at Aldersgate, a surface extension is not feasible, owing to the narrowness of the street, and the great number of vehicles standing in front of the business houses. The tramway route leading to this point serves the important districts of Clerkenwell, Pentonville, Islington, Dalston, and Hackney, and extensions could readily be made further north. The traffic tributary to this route and its connections is large, and is most insufficiently served by the Aldersgate terminus, which is too far removed from "points of destination." A surface extension being financially speaking impracticable, underground construction would be required passing over or under the Metropolitan Railway and terminating in a station near Cheapside (marked Route No. 19 in red on Plan No. 9), preferably so near the surface as to avoid the necessity for lifts, with a possible extension to Southwark Bridge. The increased traffic developed by the electrification of the converging tramways and the central location of a station at Cheapside would probably render profitable this short underground section of about 880 yards). In the event of the City authorities constructing a new bridge westward of Southwark Bridge with an approach to Aldersgate Street, the route for the tramway could follow the new street to that bridge and join the southern tramways.

Aldersgate to General Post Office.

lan No. 9.

Future extension.

In addition to other tramways on the surface or in subway, there should be a surface tramway serving the districts lying between the river and the Metropolitan District Railway as it traverses Chelsea. Such a tramway

King's Road, Sloane Square, and Victoria Station.

could well run from Putney Bridge *via* King's Road, to Sloane Square, thence to Victoria, *via* the Pimlico and Buckingham Palace Roads (marked Route No. 20 in red on Plan No. 9, also *see* Plan No. 18 facing page 82), and along Victoria Street to Parliament Street (marked Route No. 21 in red on Plan No. 9), making connection at Westminster with the lines across Westminster Bridge, and along the Victoria Embankment and Whitehall.

Plans Nos. 9, 18.

Victoria Street, Westminster.

Widening of Victoria Street, Westminster.

Victoria Street, as originally constructed, had a width of over 80 feet, between the limits of private properties with a roadway 40 feet wide, and with large open areas between the buildings and the footways. By a gradual transformation Victoria Street has become a shopping thoroughfare, and many of the owners have voluntarily covered over these open areas in order better to accommodate their business, throwing the available space into the footways. If this practice were continued throughout, and the remaining areas taken, the roadway could be easily widened to 48 feet, or even more, leaving footways as wide as at present, and, if desired, moderate open areas for the ventilation of basements. Such a widening, with the present cab-stand removed, would give a sufficient width for a double line of tramway and allow the omnibus traffic to continue, although that would in all probability soon disappear wholly or in part.

Tramways should pass the great railway termini.

Most of the great railway terminal stations have subway connection for foot passengers with some underground railway, and many of such connections are being improved or extended. In addition to such underground connections, the travelling public will be much benefited if an electric tramway can be laid to each station. If the general plan above outlined can be carried out, London Bridge, Waterloo, Vauxhall, Paddington, St. Pancras and King's Cross Stations would have convenient tramway connection leading either directly to "points of ultimate destination" or to other lines leading thereto.

Marylebone and Euston Roads.

A tramway line along the Marylebone and Euston Roads (marked Route No. 22 in red on Plan No. 9, also *see* Plan No. 19 facing this page), the widening of which is suggested, would serve to connect Paddington, Marylebone, Baker Street, Euston, St. Pancras and King's Cross Stations by tramway, carrying traffic from Paddington easterly and from St. Pancras and King's Cross westerly. From this east and west line a branch could well be taken northerly along Upper Baker Street and Finchley Road to Child's Hill (marked Route No. 23 in red on Plan No. 9, also *see* Plan No. 20 facing this page), to connect there with the Middlesex County Council light railway now under construction. Liverpool Street and Broad Street Stations and Fenchurch Street Station could also be served by combined surface and subway tramways or "tube" railways.

Plan No. 9.

Plan No. 19, facing.

Upper Baker Street and Finchley Road.

Plan No. 20.

Widths of streets.

The routes along which it is suggested that tramways should be laid vary considerably in width. Plans Nos. 10 to 20, and Table No. 8, give the widths of all the streets embraced in this report, from which it will be seen that the distance between the kerbs varies from a minimum of 20 feet to a maximum of 80 feet. The plans also indicate the lengths and situations of constructed portions and the nature of the property which fronts on the routes in question.

Plans Nos. 10, 11, 15, 18, 19, 20.

Plans Nos. 12, 13, 14, 16, and 17.

Variation of ownership should be eliminated in the working of tramways.

In outlining as above a general scheme of tramway development, the variations in ownership and the control of the several component systems have been disregarded, for, as a practical matter, if any approach to a complete and satisfactory system of tramway transit is to be created for London, such variations ought to be eliminated or greatly modified at least so far as working arrangements are concerned. The general plan herein contemplated is proposed, not for the benefit of the owners of such component systems, although of necessity their profits will increase through the greater traffic, but is devised for the general public convenience and to facilitate the carrying on of internal passenger traffic conveniently and economically from the point of view of time saved. Any conditions which prevent physical connection, where the lines of different owners come together, or compel through passengers unnecessarily to alight and change cars, are, from the standpoint of the public, and the general welfare of London, intolerable, and should be absolutely swept away. It is obvious that, as a matter of general principle, all cars should

Table No. 8.

Through running

be permitted to continue their journey onward uninterruptedly and without "change of crew." Even if the lines are extended so as to meet north and south, east and west, but with no through running, only a partial benefit would be derived if the cars are turned back; for all the disadvantages of the present fixed termini would remain. The maximum benefits will be derived when, by means of freely exchanged running powers, or by interchange, or by continuous ownership, or by lease and ownership, division lines between the several companies and corporations are, for transportation purposes, forgotten, so that the cars may run over such routes, for such distances, and in such numbers, as traffic considerations alone demand.

Universal running powers for all tramways in "Greater London."

It is not for us to consider questions of working by municipalities or companies. The whole question of tramways has been treated by us quite broadly. We should like, however, to point out that, if the London County Council is to operate all tramways within the limits of the Administrative County, then the interests of the external lines, the importance of which is already great, and is rapidly growing, must be safeguarded by some system of running powers or through cars in their favour; for these outlying districts form an integral part of "Greater London."

Advantage of one working company.

We would, however, like to call the attention of the Royal Commission to the possibility of securing the desired uniformity by means of the public authorities constructing the tramways and leasing the same to a central company, under proper conditions of control over passenger rates and modes of working, the latter paying to the former a fixed rental or a sliding-scale rental on the basis of traffic results. Public authorities can borrow money at a lower rate of interest than private companies, and hence a fixed rental based on the ordinary interest charges to a commercial company would repay the outgoing interest of the corporation, furnish a sinking fund, and possibly a profit.

Municipally constructed railways in other cities.

The system of municipally constructed urban railways has been found to answer exceedingly well in other cities, *e.g.*, Paris, New York and Boston, producing economy in finance, relief to the municipality from the burden and risk of working, and yet securing to it the ownership and control of the methods of working and of the service to be afforded; assuring to it a profit from operation, and in some cases in addition an income from the rates assessed upon the railway so constructed.

Effect of tramways on omnibuses.

Nearly all the routes described are routes now traversed by omnibus lines. When tramcars reach the "points of destination," and thus become for the first time in London on an equal footing, in that respect, with omnibuses, the latter will, no doubt, except in special cases, disappear. It has been the inevitable rule elsewhere that the more efficient vehicle drives out the less efficient, provided a sufficient measure of service is supplied. A considerable amount of the present congestion in London streets is due to omnibuses, as will appear from the tables of vehicular traffic counts in the Appendix and the instructive diagram of omnibus routes handed in by Mr. Harper, the Statistical Officer of the London County Council, in his evidence[1] before the Royal Commission. At best, the maximum speed of horse omnibuses is low, and, as the power of acceleration and retardation is small, the average speed is much below the maximum, while, since omnibuses run in large numbers on the streets forming the chief traffic routes, they tend to set the pace thereon for the traffic in general. It is argued in favour of omnibuses that, being fixed to no special part of the road, their elasticity of movement aids them in threading their way; but, on the other hand, this very elasticity which permits omnibuses to turn out from stopping places out of their proper order, and to meander and move sideways on the roads, and to be driven two or more abreast is, in many cases, a material element in road congestion.

ate VIII., l. V.

Omnibus routes.

Tramways relieve congestion.

Much evidence has been laid before the Royal Commission to the effect that tramways relieve congestion, in that the cars, being on fixed lines, run straight and therefore occupy the minimum of road space; that, for an equal length of route operated by tramcars and by omnibuses with horses, the former have a much greater carrying capacity; that, on account of the former's higher speed, irrespective of the size of car, not only is the public

[1] See Plate VIII., Vol. V.

better served, but fewer vehicles afford the same service; that, on account of the higher speed of the governing unit, the average speed of all the vehicles on the roadway is increased, thus increasing the capacity of the street; that tramway cars are not deflected as omnibuses are by road obstructions, but can pass over openings; and that they oblige the slow traffic to pass next to the kerb, leaving, as is proper, the centre of the roadway for fast traffic. Experience in other cities demonstrates that these views as expressed in the evidence are generally sound.

Effect of tramways in Liverpool.

As an illustration of this, and to show how completely the improvement of facilities, not only increases the traffic, but drives out the inferior vehicle, Liverpool is an interesting and fair example.

Liverpool tramways traffic 1897–1903.

From the report of the General Manager of the Liverpool Corporation Tramways for the year 1903 Table L has been prepared, which gives the details of traffic over that system, for the years 1897 to 1903, both inclusive, the period over which the substitution of electric traction for horses extended.

TABLE L.

LIVERPOOL TRAMWAYS.

——	1897	1898	1899	1900	1901	1902	1903
Passengers:							
Electric Cars..	—	785,064	15,853,160	58,068,531	100,076,789	108,906,472	113,015,728
Horse Cars ...	30,596,229	31,985,158	39,321,946	19,051,875	218,166	74,685	41,506
Omnibuses ..	7,812,855	9,001,812	8,596,344	5,247,552	813,825	354,428	—
	38,409,084	41,772,034	63,771,450	82,367,958	101,108,780	109,335,585	113,057,234
Mileage:—							
Electric Cars...	—	53,197	1,473,750	5,584,357	10,771,461	11,705,425	11,724,097
Horse Cars ...	4,674,609	4,736,103	4,758,652	2,571,153	46,247	16,534	10,741
Omnibuses ...	1,338,573	1,490,458	1,368,144	945,346	152,355	68,856	—
	6,013,182	6,279,758	7,600,546	9,100,856	10,970,063	11,790,815	11,734,838

Result of tramway electrification in Liverpool.

The above table, being a typical representation of the results of the introduction of mechanically-operated tramways, is worthy of examination. At the beginning of the seven years under review the public local transportation service in Liverpool was provided partly by horse-hauled tramcars and partly by omnibuses. In the second year electric cars were run for the first time. During the three following years, 1899 to 1901, nearly all the traffic routes were re-constructed for and in operation by electrical power, and by 1903 the system was complete, and numerous additional lines had been constructed. In addition to the information contained in Table L, the General Manager of the Liverpool Tramways has given us the number of vehicles of each class required to perform the service, under the different conditions mentioned, as follows:—

TABLE LI.

LIVERPOOL TRAMWAYS.

Year.	Horse Cars.	Omnibuses.	Electric Cars.	Total.	No. of Passengers.
1897 -	197	68	—	265	38,409,084
1898 -	199	74	12 (During November and December.)	285	41,772,034
1899 -	240	64	37	341	63,771,450
1900 -	102	42	153	297	82,367,958
1901	2	7	355	364	101,108,780
1902 -	1	5	380	386	109,335,585
1903 -	1	—	407	408	113,057,234

It will be seen that the greatest growth in the number of passengers took place between the years 1898 and 1900, during which time the existing lines were being electrified rather than new ones being built, so that the route mileage remained substantially unaltered. In this period the traffic was doubled, whereas an increase of only 12 vehicles on 285 accommodated the greater business. The general results of the tramway electrification have been a growth of passengers from 38,409,084 to 113,057,234, an increase of about 300 per cent., and the elimination of both the horse tramcar and the omnibus, and that, for equal traffic, fewer vehicles under modern conditions suffice. The results shown in Liverpool are repeated in other cities both at home and abroad.

Expansion of traffic in Liverpool.

It is right, however, to point out that, admitting the force of all these opinions and facts, the present width of the streets of London is frequently too narrow for tramcars, and that the general opinion of the police and local authorities is adverse to their introduction (except in special cases), unless the streets which are too narrow for their present traffic can be widened.

Widenings of streets necessary.

In our opinion, as we have stated, weight must be attached proportionately to the local conditions on different routes, and to the diminution and regulation of other traffic on such routes to be expected from the introduction thereon of tramcars.

Weight to be attached to local consideration.

In this connection, notice should be taken of the nature of the present vehicular traffic on each route, for which purpose we direct attention to the returns which we have procured of the character or description of vehicles on various streets, and at various crossings, which are referred to in the tables and diagrams relating to vehicular traffic. Omnibuses will undoubtedly be very largely diminished in numbers on the introduction of tramway cars, which reach the "points of destination," and in many cases will disappear altogether, while some diminution of cabs may perhaps result, though this is more doubtful. There will remain unaffected, however, the carts, barrows, bicycles, private carriages and motors, together with the standing vehicles, which now, with the omnibuses, produce much of the congestion of the streets of London. The problem so far as congestion is concerned is thus reduced to a question whether omnibuses or tramcars are the more convenient way of conveying traffic in a public street. In these remarks, we purposely limit ourselves to the effect on the streets, for, as to the general advantages to London of tramway facilities, we have no doubt.

Vehicular traffic tables and diagrams.

The above remarks as to omnibuses have been made with reference to omnibuses drawn by horses, but many of the views expressed would have to be modified considerably if a comparison has to be made between electric tramcars and motor omnibuses, the future of which is at present uncertain. The tentative working in London of motor omnibuses within the past twelve months distinctly indicates that a rate of speed can be practically maintained by them which compares not unfavourably with the speed of electric tramcars in similar thoroughfares (*see* Table XVIII., page 24, and Tables Nos. 6 and 7 in the Appendix). We find also that the present small number of motor omnibuses in use on the streets of London is to be augmented materially.

Motor omnibuses.

Table XVIII. Tables Nos. 6, 7.

The chairman of the London Omnibus Owners' Federation, Mr. J. L. Pound, expressed himself to the Royal Commission as hopeful and even confident as to the successful introduction of the motor omnibus in London, and of its being able to compete with the electric tramcar.

The time in our opinion has not arrived for a definite judgment to be formed as to the practical and financial prospects of the motor omnibus in London, and of its true position in a system of rapid transit relatively to the electric tramcar. Whatever may be the eventual result, however, of the rival systems, the recommendations which we have made as to routes and similar matters, including the widening of streets, will remain unaltered.

In considering the general scheme herein contemplated, it is to be borne in mind that the improvements proposed are not to be considered alone in the light of existing traffic. The facilities for traffic in London are so inferior to those found in other cities, both in extent, convenience, rate of speed, connections, and quality of service, that the volume of traffic now existing is certainly much less than what it would be under proper and reasonable conditions. With increased facilities, there will be a largely

With increased facilities traffic will increase.

Central London Railway and Omnibuses in Oxford Street.

increased traffic, which has already been shown to be the case in London in connection with the Central London Railway. For a short while after the opening of that line, the number of omnibuses on the route decreased; but, at the present time, there are more omnibuses running along Oxford Street than previously, although the Central London Railway is carrying annually 45,000,000 passengers. This failure to reduce permanently the number of omnibuses is probably largely due to the fact that the Central London Railway with its lifts is not adapted to the short-distance service rendered by the omnibus. On the other hand, it serves to illustrate how new traffic is created by new facilities.

Lines suggested only primary lines.

Plan No. 9 and the Key Plan already referred to will be found on the following page, and show the lines already existing and those described above. The new lines herein described are to be considered as main or primary lines. Branches, extensions, and subsidiary lines will be needed, but such secondary lines can be constructed where and when traffic conditions so require.

Plan No. 9 Key Plan.

DIAGRAM No 88.
(See Table No 66).

ROYAL COMMISSION ON LONDON TRAFFIC.
REPORT OF ADVISORY BOARD.

DIAGRAM SHOWING THE NUMBER OF PASSENGERS TO AND FROM VARIOUS RAILWAY TERMINI DURING THE YEAR 1903.

TERMINUS. OWNER
Nº OF PASSENGERS
Liverpool Street ..... G.E. 65,299,450
Waterloo ..... L&S.W. 31,000,000
Broad Street ..... N.L. 26,694,636
Fenchurch Street ..... G.E. and L.T.&S. 23,924,848
London Bridge ..... L.B.&S.C. 23,740,676
Victoria ..... L.B.&S.C. 18,559,794
Kings Cross. & York Road ..... G.N. 15,377,365
Cannon Street ..... S.E.&C. 13,539,363
Baker Street ..... Met. Extn. 13,250,187
Victoria ..... S.E.&C. 10,859,037
Holborn Viaduct ..... S.E.&C. 10,668,938
Charing Cross ..... S.E.&C. 10,174,267
St Pancras ..... Mid. 9,766,741
Paddington & Bishops Rd. G.W. 9,173,616
London Bridge ..... S.E.&C. 6,042,707
Ludgate Hill ..... S.E.&C. 4,814,359
Euston ..... L&N.W. 4,469,500
Addison Road ..... W.L.&W.L.J. 4,104,010
St Pauls ..... S.E.&C. 3,791,692
Vauxhall ..... L&S.W. 2,224,680

304 5.05.

Weller & Graham, Ltd Litho. London.

RAILWAYS.

Railway traffic divided into three classes.

The railway traffic of London may, like the tramway traffic, be divided into three classes:—the traffic on the main-lines coming from a distance; the suburban traffic from the outer-belt of "Greater London"; and the urban traffic within the Metropolis itself.

Most of the main-line companies cater for suburban traffic, and the urban railways have in many cases pushed out branches to serve the suburban districts, but few of the former do anything for the urban traffic.

The attempt to cater for the three classes not a success.

The attempt to cater for the three or even two distinct classes of passengers on the same railway has not, in our opinion, been crowned with success. The long-distance traveller is frequently delayed by stoppages for the convenience of the suburban passenger, and the latter is conveyed slowly by reason of the omnibus-like traffic of the urban railways, which, with their frequent stations, discount the advantages of a railway by affording a service more comparable with that of a tramway.

Plan No. 21.

Plan showing main-lines, suburban and urban railways.

Plan No. 21 is attached at the end of this report to page 139, and shows the existing main-lines, suburban lines and urban lines of "Greater London," also the lines in course of construction, and those for which powers have been granted but which are not yet made. The main-line services are shown in black lines, the suburban services in green lines, and urban services in red lines. The five sections into which we have divided "Greater London" are also denoted.

Main-line termini.

The following is the grouping of the main terminal stations of London: -

"Western Section"	Paddington—Great Western Railway. Marylebone—Great Central Railway. Euston—London and North Western Railway.
"Northern Section"	St. Pancras—Midland Railway. King's Cross—Great Northern Railway.
"Eastern Section"	*Liverpool Street—Great Eastern Railway.
"South-Eastern Section"	London Bridge—South Eastern and Chatham Railway. London Bridge—London, Brighton and South Coast Railway. *Cannon Street—South Eastern and Chatham Railway. *St. Paul's—South Eastern and Chatham Railway. *Holborn Viaduct—South Eastern and Chatham Railway. Charing Cross—South Eastern and Chatham Railway.
"South-Western Section"	Victoria—South Eastern and Chatham Railway. Victoria—London, Brighton and South Coast Railway. Waterloo—London and South Western Railway. Addison Road—West London and West London Extension Railways.

Total 16, of which 4 (marked *) are in the City.

Diagrams showing number of passengers using main-line termini.

Diagram No. 88, facing.

Diagram No. 75.

Diagram No. 88, facing this page, shows the number of passenger journeys to and from the above stations during one year, arranged according to the volume of traffic. Diagram No. 75, facing page 75, shows the number of passengers to and from various railway and tramway termini on an average week-day, arranged in a like order.

Main-line railways: "Western Section."

In the "Western Section" the main-line railways are :—

Great Western Railway.

The Great Western Railway, having its terminus at Paddington; the accommodation provided at Paddington and Bishop's Road for passenger traffic consists of two main-line departure platforms, two main-line arrival platforms, four suburban departure platforms, three suburban arrival platforms, or a total of eleven platforms served by six lines of railway.

Suburban service.

The suburban services of the Great Western Company from Paddington are to Westbourne Park, Acton, Ealing, Hanwell, Southall, West Drayton, Uxbridge, Slough and Windsor, etc.; and from Aldgate over the Metropolitan Railway *via* Bishop's Road to the same places. In addition the Great Western Company have a suburban service from Victoria over the South Eastern and Chatham, the West London Extension and the West London Joint Railways to those suburban stations above mentioned which are west of Acton. Rail-motor-car services are provided from Westbourne Park to Acton, Ealing, Southall, Brentford, Hanwell, Park Royal Greenford, Elthorne, Willesden Junction, etc. The number of passengers dealt with at Paddington and Bishop's Road is approximately 9,174,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix). *Tables Nos. 66, 67.*

Great Central Railway.

The Great Central Railway, having its terminus at Marylebone: the accommodation provided for passenger traffic consists of two departure platforms and two arrival platforms, making a total of four platforms served by two lines of railway.

Suburban service.

At present the Great Central Company cannot deal with any suburban traffic until after the completion of the Great Central and Great Western Joint Lines of 1899. The number of passengers dealt with at Marylebone is approximately 471,000 per annnm. (*See* Tables Nos. 66 and 67 in the Appendix). *Tables Nos 66, 67.*

London and North Western Railway.

The London and North Western Railway, having its terminus at Euston; the accommodation provided for passenger traffic consists of seven main-line departure platforms, two main-line arrival platforms, five suburban departure and arrival platforms, making a total of fourteen platforms served by four lines of railway.

Suburban service.

The suburban services of the London and North Western Company are run from Euston to Chalk Farm, Kilburn, Willesden, Wembley, Harrow, Bushey, and Watford, etc.; and from Willesden Junction over the West London Joint and the West London Extension, and the London, Brighton and South Coast Railways to Streatham, Crystal Palace, Croydon, etc.; and from Willesden Junction to Broad Street over the North London Railway. The number of passengers dealt with at Euston is approximately 4,470,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix). *Tables Nos. 66, 67.*

Diagram of passenger traffic: "Western Section" hour by hour.

Diagram No. 89 facing this page, shows the passenger traffic at stations of a terminal character within the "Central Area" of London,—"Western Section," hour by hour on an average week-day. Diagram No. 89.

Main-line railways: "Northern Section."

In the "Northern Section" the main-line railways are :—

Midland Railway.

The Midland Railway, having its terminus at St. Pancras: the accommodation provided for passenger traffic consists of three main-line departure platforms, two main-line arrival platforms, and two suburban departure and arrival platforms, making a total of seven platforms served by four lines of railway.

Suburban service

The suburban services of the Midland Company are run from St. Pancras and from Moorgate Street over the Metropolitan Railway (Widened Lines) *via* King's Cross, to Kentish Town, Tufnell Park, Holloway, Crouch Hill, Harringay, Tottenham, Walthamstow, Leyton, East Ham, etc.; and to Kilburn, Cricklewood, Hendon, Elstree and St. Albans, etc.; and from Victoria over the South Eastern and Chatham and the Metropolitan Railways *via* Ludgate Hill and Farringdon Street to St. Albans, etc.; and to East Ham, etc. The number of passengers dealt with at St. Pancras is approximately 9,767,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix). *Tables Nos. 66, 67.*

Great Northern Railway.

The Great Northern Railway, having its terminus at King's Cross: the accommodation provided for the passenger traffic at King's Cross and York Road consists of two main-line departure platforms, two main-line arrival

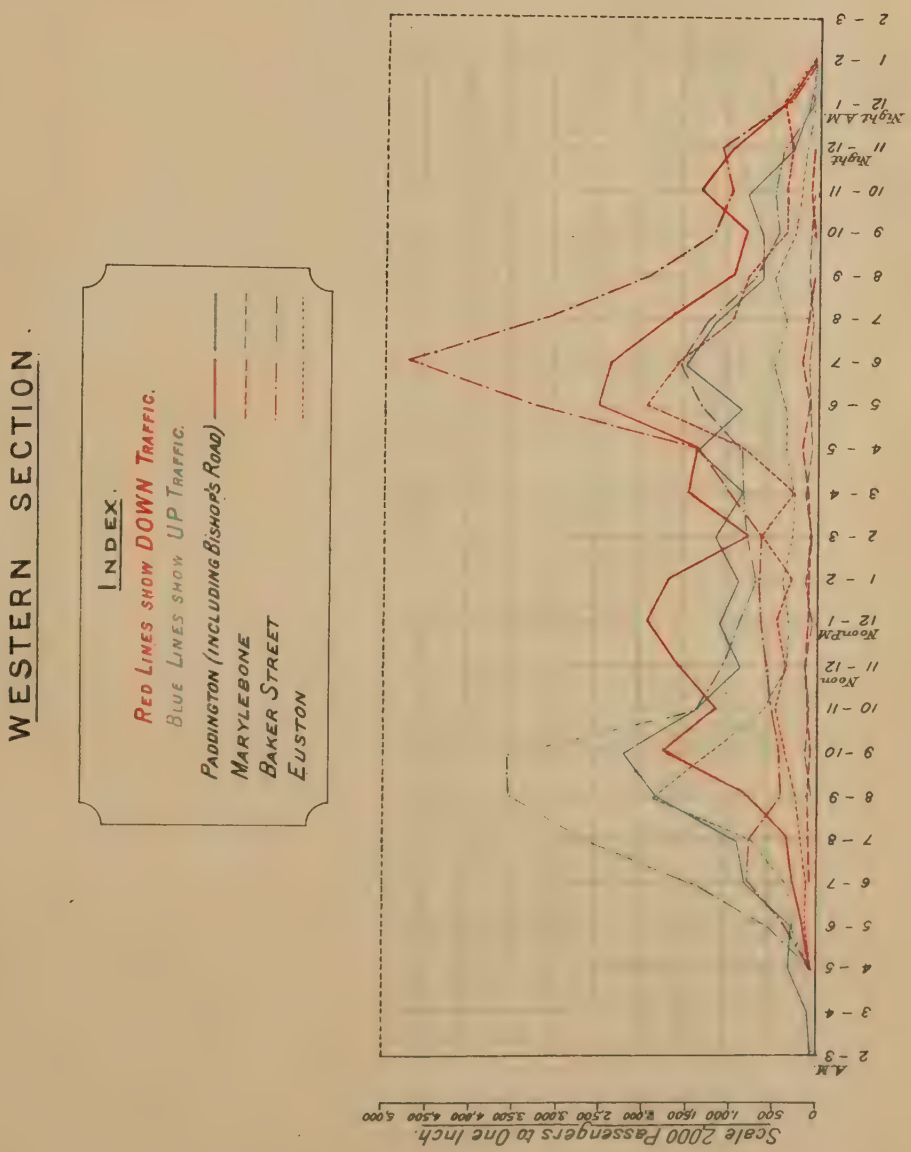
DIAGRAM N°8
(See Table N° 67)

ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

DIAGRAM SHOWING PASSENGER TRAFFIC AT STATIONS OF A TERMINAL CHARACTER WITHIN THE CENTRAL AREA OF LONDON.

WESTERN SECTION.



5104 5 05

Weller & Graham, Ltd. Litho London

AGRAM Nº 90.
e Table Nº 67)

ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

DIAGRAM SHOWING PASSENGER TRAFFIC AT STATIONS OF A TERMINAL CHARACTER WITHIN THE CENTRAL AREA OF LONDON (CONTD)

NORTHERN SECTION.

INDEX.

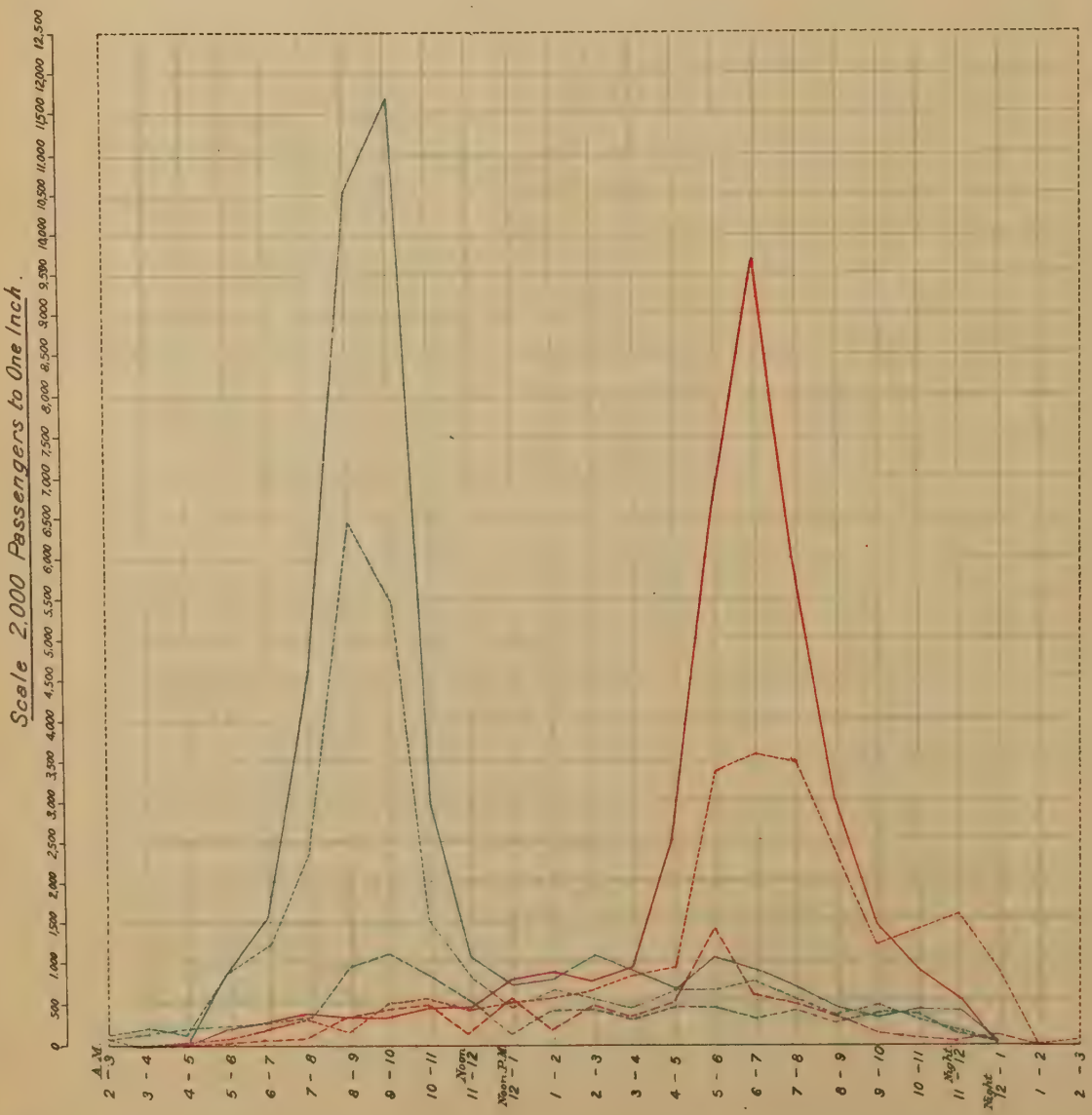
RED LINES SHOW DOWN TRAFFIC.

BLUE LINES SHOW UP TRAFFIC.

ST PANCRAS

KING'S CROSS (INCLUDING YORK ROAD)

BROAD STREET



5104.5·08.

Weller & Graham, Ltd Litho. London.

platforms, five suburban departure platforms, three suburban arrival platforms, making a total of twelve platforms served by six lines of railway.

Suburban service.

The suburban services of the Great Northern Company are run from King's Cross and from Moorgate Street over the Metropolitan Railway (Widened Lines), and from Victoria over the South Eastern and Chatham and the Metropolitan Railways *via* Ludgate Hill and Farringdon Street to Holloway, Finsbury Park, Highgate, Finchley, Edgware, Harringay, Hornsey, Wood Green, Winchmore Hill, Enfield, Southgate, Barnet, Potters Bar, and Hatfield, etc. The number of passengers dealt with at King's Cross and York Road is approximately 15,377,000 per annum. (*See* Tables No. 66 and 67 in the Appendix).

Tables Nos. 66, 67.

Diagram No. 90 facing.

Diagram of passenger traffic: "Northern Section" hour by hour.

Diagram No. 90 facing this page, shows the passenger traffic at stations of a terminal character within the "Central Area" of London,—"Northern Section," hour by hour on an average week-day.

In the "Eastern Section" the only main-line railway is:—

Main-line railway: "Eastern Section," Great Eastern Railway.

The Great Eastern Railway, having its termini at Liverpool Street for main-line and suburban traffic and at Fenchurch Street for suburban traffic only; the accommodation provided for passenger traffic at Liverpool Street consists of two main-line departure platforms, two main-line arrival platforms, fourteen suburban departure and arrival platforms, making a total of eighteen platforms served by six lines of railway. The accommodation provided at Fenchurch Street consists of four suburban departure and arrival platforms served by four lines of railway, of which two lines are used jointly with the London, Tilbury and Southend Railway. This Company also has access to St. Pancras over the Tottenham and Hampstead Railway, *via* South Tottenham.

Suburban service.

A most important series of suburban services are run by the Great Eastern Company from Liverpool Street, and from Fenchurch Street to Bethnal Green, Hackney, Stoke Newington, Stamford Hill, Wood Green, Clapton, Tottenham, Edmonton, Enfield, Ponders End, Waltham, Cheshunt, Broxbourne, Hoddesden, Chingford, Walthamstow, Stratford, Bow, Stepney, Poplar, Millwall, Blackwall, Canning Town, Silvertown, Beckton, Woolwich, New Cross, Croydon, Leyton, Leytonstone, Snaresbrook, Woodford, Loughton, Epping, Chigwell, Fairlop, Barkingside, Forest Gate, Ilford, Seven King's, Chadwell Heath, Romford, and Brentwood, etc. The approximate number of passengers dealt with by this Company at Liverpool Street is 65,299,000 per annum, and at Fenchurch Street 10,660,000, making a total of 75,959,000 passengers per annum. (*See* Tables Nos. 66 and 67 in the Appendix).

Tables Nos. 66, 67.

Diagram No. 91.

Diagram of passenger traffic: "Eastern Section" hour by hour.

Diagram No. 91, facing page 94, shows the passenger traffic at stations of a terminal character within the "Central Area" of London,—"Eastern Section," hour by hour on an average week-day.

In the "South-Eastern Section" the main-line railways are:—

Main-line railways: "South-Eastern Section.' South Eastern and Chatham Railway.

The South Eastern and Chatham Railway, having termini at London Bridge, Cannon Street, St. Paul's, Holborn Viaduct, and Charing Cross: the accommodation provided for passenger traffic at those termini consists of, at London Bridge (Low Level) four suburban departure and arrival platforms; at London Bridge (High Level), two main-line departure platforms (down), two main-line and suburban arrival platforms (up), and two suburban departure platforms (down), making a total of ten platforms served by four lines of railway; at Cannon Street, three main-line departure and arrival platforms (down), three main-line and suburban departure and arrival platforms (up), three suburban departure and arrival platforms (down), making a total of nine platforms served by four lines of railway; at St. Paul's, one main-line and suburban departure platform, one main-line and suburban arrival platform, three main-line and suburban departure and arrival platforms, making a total of five platforms served by four lines of railway; at Holborn Viaduct, one main-line and suburban departure platform, one main-line and suburban arrival platform, four suburban departure and arrival platforms, making a total of six platforms served by four lines of railway; at Charing Cross,

two main-line departure platforms, two main-line and suburban arrival platforms, two suburban departure platforms, making a total of six platforms served by four lines of railway.

Suburban service.

The suburban services of the South Eastern and Chatham Companies are run from these termini and from Moorgate Street over the Metropolitan Railway to New Cross, Greenwich, Charlton, Woolwich, Lewisham, Blackheath, Lee, Hither Green, Erith, Dartford, Eltham, Welling, Bexley, Sidcup, Camberwell, Herne Hill, Dulwich, Catford, Nunhead, Sydenham, Crystal Palace, Bromley, Chislehurst, St. Mary Cray, Orpington, Beckenham and Hayes etc. Through services are also provided from Woolwich to Finsbury Park (G.N.R.), *via* Snow Hill and from Victoria to Kentish Town (M.R.), *via* Snow Hill.

The number of passengers dealt with at the various termini of the South Eastern and Chatham Railway situated in this district is approximately as follows:—At the London Bridge Station of the South Eastern and Chatham Railway, 6,042,000; at Cannon Street, 13,539,000; at St. Paul's, 3,791,000; at Ludgate Hill, 4,814,000; at Holborn Viaduct, 10,669,000; at Charing Cross, 10,174,000; making a total of 49,000,000 passengers per annum. (*See* Tables Nos. 66 and 67 in the Appendix). *Tables Nos. 66, 67.*

London, Brighton and South Coast Railway.

The London, Brighton and South Coast Railway, having a terminus in this section at London Bridge: the accommodation provided there for the passenger traffic consists of four main-line and suburban departure and arrival platforms, seven suburban departure and arrival platforms, making a total of eleven platforms served by four lines of railway.

Suburban service.

The suburban services of the London, Brighton and South Coast Company are run to New Cross, Peckham, Dulwich, Tulse Hill, Clapham, Wandsworth, Balham, Anerley, Streatham, Norbury, Norwood, Crystal Palace, Penge, Croydon, Purley, Sutton, Tooting, Mitcham, Merton, and Epsom, etc. The number of passengers dealt with at the London Bridge Station of the London, Brighton and South Coast Railway is approximately 23,741,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix). *Tables Nos. 66, 67.*

Diagram of passenger traffic: "South-Eastern Section" hour by hour.

Diagram No. 92, facing page 95, shows the passenger traffic at stations of a terminal character within the "Central Area" of London,—"South-Eastern Section," hour by hour on an average week-day. Diagram No. 92.

Main-line railways: "South-Western Section."

In the "South-Western Section" the main-line railways are:—

London and South Western Railway.

The London and South Western Railway, having termini at Waterloo and Addison Road: the accommodation provided for the passenger traffic at Waterloo consists of three main-line departure platforms, two main-line arrival platforms, eleven suburban departure and arrival platforms, making a total of sixteen platforms served by eight lines of railway.

Suburban service.

The suburban services of the London and South Western Company are run to Clapham, Wimbledon, Putney, Barnes, Chiswick, Kew, Brentford, Hounslow, Staines, Twickenham, Richmond, Malden, Kingston, Teddington, Surbiton, Hampton Court, Esher, Walton, Weybridge, Chertsey, Worcester Park, Ewell, Epsom and Leatherhead, etc. A through service is provided from Ludgate Hill to Wimbledon. The number of passengers dealt with at Waterloo is approximately 31,000,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix). *Tables Nos. 66, 67.*

South Eastern and Chatham Railway.

The South Eastern and Chatham Railway, having a terminus in this section at Victoria: the accommodation provided for the passenger traffic consists of two main-line departure platforms, two main-line arrival platforms, four suburban departure and arrival platforms, making a total of eight platforms served by four lines of railway.

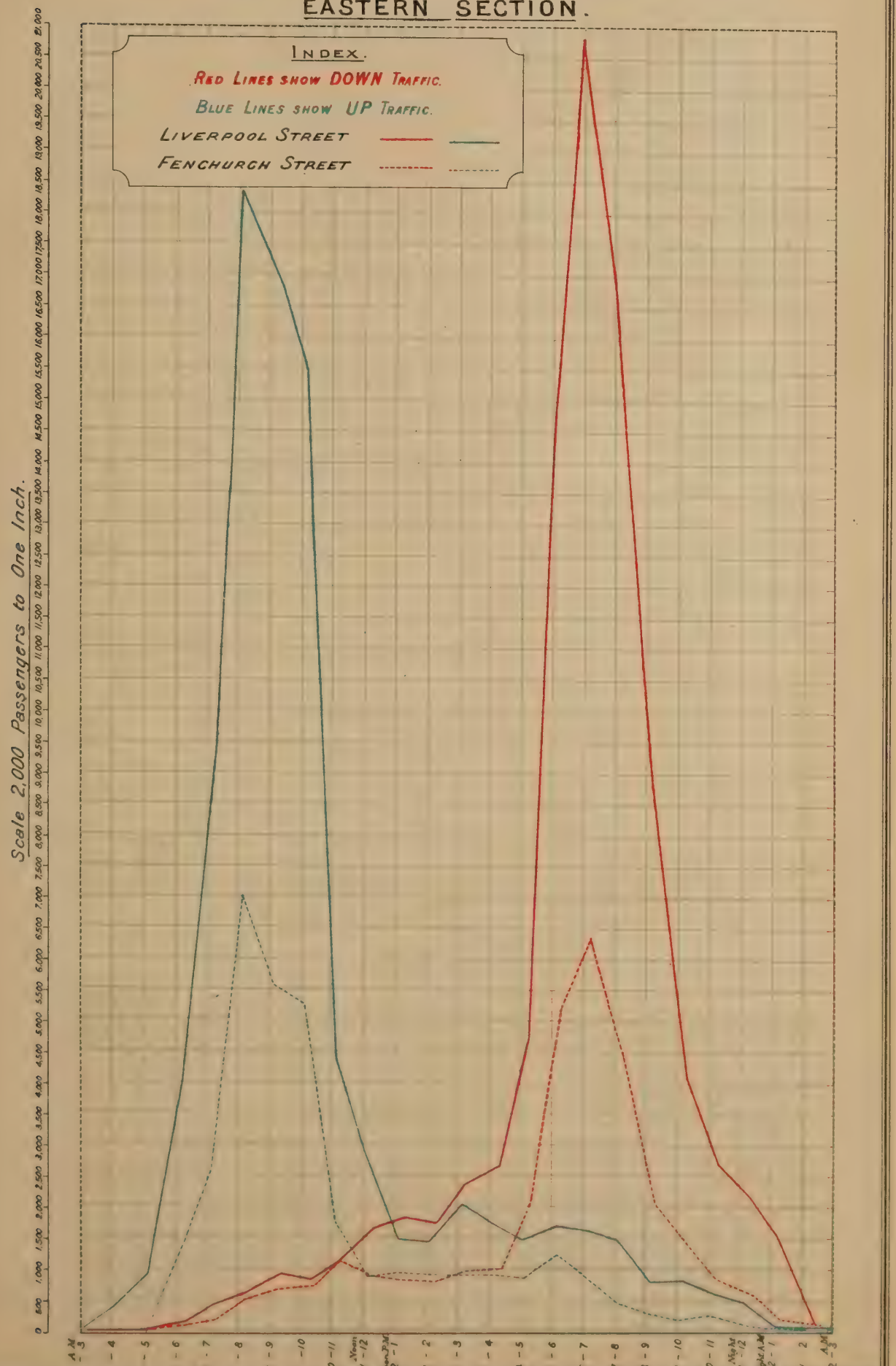
Suburban service.

The suburban services from this station are run to New Cross, Greenwich, Charlton, Woolwich, Lewisham, Blackheath, Lee, Hither Green, Erith, Dartford, Eltham, Welling, Bexley, Sidcup, Camberwell, Herne Hill, Dulwich, Catford, Nunhead, Sydenham, Crystal Palace, Bromley, Chislehurst, St. Mary Cray, Orpington, Beckenham and Hayes, etc. The number of passengers dealt with by this Company at their Victoria Station is approximately 10,859,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix). *Tables Nos. 66, 67.*

DIAGRAM N
(See Table N°

DIAGRAM SHOWING PASSENGER TRAFFIC AT STATIONS OF A TERMINAL CHARACTER WITHIN THE CENTRAL AREA OF LONDON (CONTD)

EASTERN SECTION.



Weller & Graham, Ltd Litho London.

IAGRAM Nº 92.
(See Table Nº 67)

ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

DIAGRAM SHOWING PASSENGER TRAFFIC AT STATIONS OF A TERMINAL CHARACTER WITHIN THE CENTRAL AREA OF LONDON (CONTD)

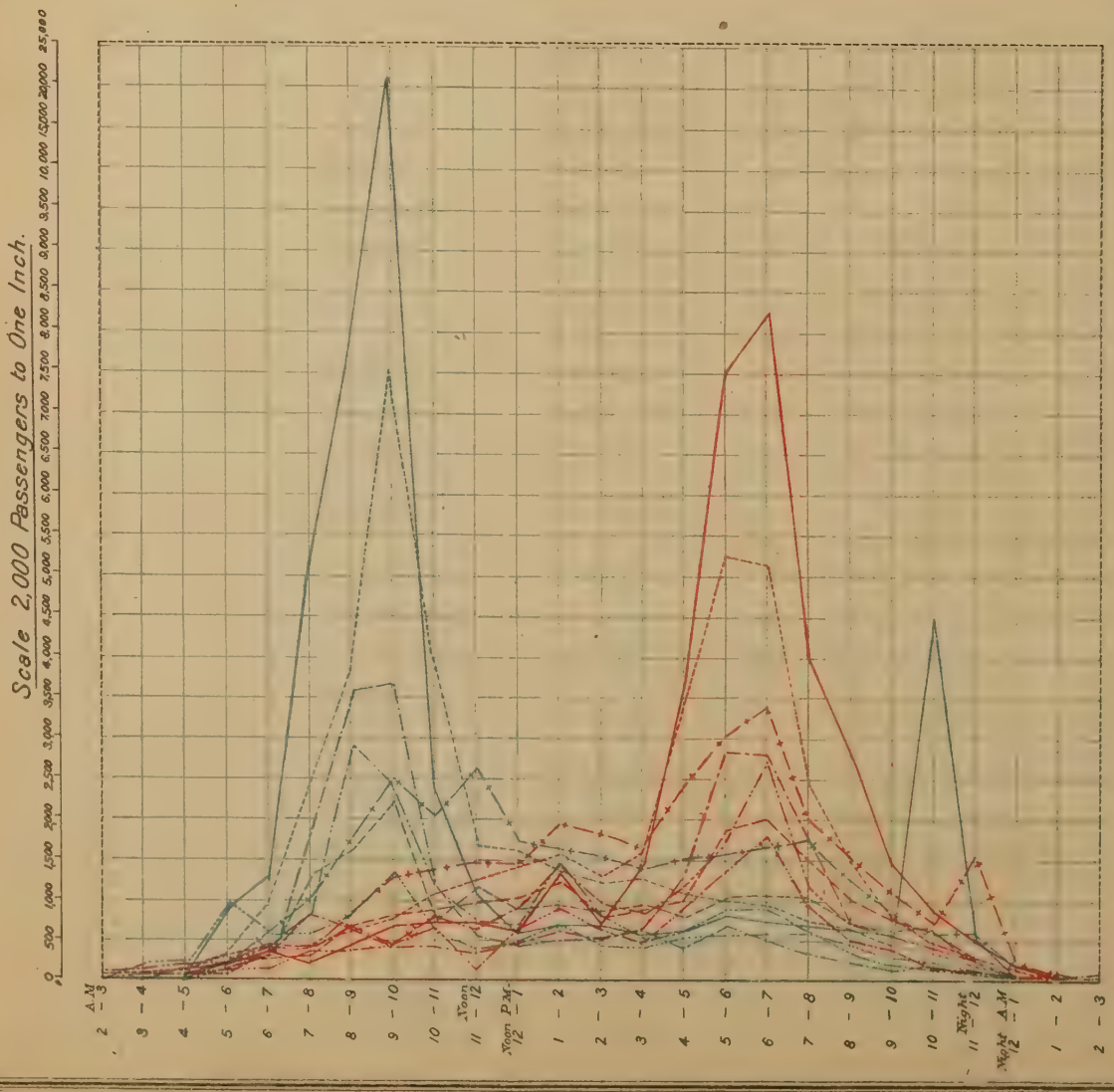
SOUTH EASTERN SECTION.

INDEX.

RED LINES SHOW DOWN TRAFFIC.

BLUE LINES SHOW UP TRAFFIC.

- LONDON BRIDGE (L.B.&S.C.RY)
- " " (S.E.&C.RY)
- CANNON STREET
- ST PAULS
- LUDGATE HILL
- HOLBORN VIADUCT
- CHARING CROSS



5104 5.05

The London, Brighton and South Coast Railway, having termini in this section at Victoria and Addison Road: the accommodation provided for the passenger traffic at their Victoria Station consists of four main-line departure and arrival platforms, and four surburban departure and arrival platforms, making a total of eight platforms, served by four lines of railway. London, Brighton and South Coast Railway.

The suburban services from this station are run to New Cross, Peckham Dulwich, Tulse Hill, Clapham, Wandsworth, Balham, Anerley, Streatham, Norbury, Norwood, Crystal Palace, Penge, Croydon, Purley, Sutton, Tooting, Mitcham, Merton, and Epsom, etc. Large and expensive additions are now being carried out by this Company at Victoria. The approximate number of passengers dealt with by this Company at their Victoria Station is 18,560,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix). Suburban service.

Tables Nos. 66, 67.

The accommodation provided for the passenger traffic at Addison Road consists of one arrival and departure down platform used by through trains, one arrival and departure up platform used by through trains, four terminal arrival and departure platforms used by London and North Western and Great Western Companies' trains, two terminal arrival and departure platforms, used by the London, Brighton and South Coast and London and South Western Companies' trains, making a total of eight platforms, served by two lines of railway. West London and West London Extension Railways.

The suburban services from this station are to Clapham Junction and thence to stations on the London, Brighton and South Coast and the London and South Western Railways, and to Richmond *via* Hammersmith, and to Willesden Junction, and thence to stations on the London and North Western Railway. The number of passengers dealt with at Addison Road Station is approximately 4,104,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix). Suburban service.

Tables Nos. 66, 67.

Diagram No. 93, facing page 96, shows the passenger traffic at stations of a terminal character within the "Central Area" of London,—"South-Western Section," hour by hour on an average week-day. Diagram of passenger traffic: "South-Western Section" hour by hour.

Diagram No. 93.

In addition to the suburban services at the above mentioned stations the following are termini devoted to suburban traffic:—

Termini devoted to suburban traffic.

Baker Street—Metropolitan Extension Railway.

St. Pancras—Great Eastern Railway.

St. Pancras—London, Tilbury and Southend Railway.

*Moorgate—Great Northern Railway.

*Moorgate—Midland Railway.

*Moorgate—South Eastern and Chatham Railway.

*Broad Street—North London Railway.

*Broad Street—London and NorthWestern Railway.

*Aldgate—Great Western Railway.

*Fenchurch Street—London, Tilbury and Southend Railway.

*Fenchurch Street—Great Eastern Railway.

Making a total of 21 stations, including the main-line stations at which suburban traffic is carried on, of which 8 (marked*) are in the City. Number of termini for suburban traffic.

The Metropolitan Extension Railway has its terminus at Baker Street. The accommodation provided for the passenger traffic consists of three departure and arrival platforms served by two lines of railway. This railway has a service of suburban trains from Baker Street to Swiss Cottage, Brondesbury, Cricklewood, Neasden, Harrow, Ruislip, Uxbridge, Northwood, Rickmansworth, Aylesbury, etc. In addition to the services from the Baker Street terminus this Company runs a suburban service east and west between New Cross and Richmond over the northern portion of the "Inner Circle" Railway. The approximate number of passengers dealt with at the terminus at Baker Street is 13,250,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix, and Diagram No. 89, facing page 92). Suburban railways. Metropolitan Railway.

Tables Nos. 66, 67. Diagram No. 89.

The North London Railway has its terminus at Broad Street: the accommodation provided for the passenger traffic consists of eight departure North London Railway.

and arrival platforms (four of which are used jointly with the London and North Western Railway) served by four lines of railway, two of which are used jointly with the London and North Western Railway. This Company runs services of trains to Shoreditch, Haggerston, Dalston, Mildmay Park, Canonbury, Barnsbury, Maiden Lane, Camden Town, Chalk Farm, Hackney, Homerton, Victoria Park, Old Ford, Bow, South Bromley, and Poplar, etc.; to Hammersmith, Kew and Richmond, *via* Willesden Junction, over the London and North Western and the North and South Western Junction Railways; to High Barnet, Potters Bar, and Enfield, *via* Finsbury Park over the Great Northern Railway, and to Plaistow *via* Bromley over the London, Tilbury and Southend Railway. The number of passengers dealt with at Broad Street is approximately 26,695,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix, and Diagram No. 90, facing page 93). *Tables Nos. 66, 67.* Diagram No. 90.

London, Tilbury and Southend Railway

The London, Tilbury and Southend Railway, has its terminus at Fenchurch Street: the accommodation provided for the passenger traffic consists of one arrival and departure platform served by two lines of railway (used jointly with the Great Eastern Railway). This Company runs services of suburban trains to Stepney, Bromley, Plaistow, Upton Park, East Ham, Barking, Tilbury, Upminster, and Southend, etc.; and also has access to the Metropolitan District Railway over the Whitechapel and Bow Railway, and to St. Pancras over the Tottenham and Forest Gate and the Tottenhan and Hampstead Railways. The number of suburban passengers dealt with at Fenchurch Street by this Company is approximately 13,265,000 per annum. (*See* Tables Nos. 66 and 67 in the Appendix, and Diagram No. 91, facing page 94). *Tables Nos. 66, 67.* Diagram No. 91.

Metropolitan District Railway.

The Metropolitan District Railway can scarcely be said to have a terminus in London, although a few trains end their journeys at the Mansion House, and at Whitechapel. It furnishes suburban services to East Ham over the Whitechapel and Bow, and the London, Tilbury and Southend Railways to New Cross over the East London Railway to Putney Bridge, and on to Wimbledon, over the London and South Western Railway; to Hammersmith; to Kew Bridge and Richmond over the London and South Western Railway; to South Ealing, Ealing, Hounslow, Sudbury, South Harrow, etc.

Authorised suburban railways

The following suburban railways are authorised, but the construction of them has not yet been commenced:—

Edgware and Hampstead Railway.

The Edgware and Hampstead Railway from Edgware to Hendon and Hampstead, with a junction with the Charing Cross, Euston and Hampstead ("tube") Railway at Golder's Green. This railway is to be an electric surface extension of the latter railway, which comes to the surface after passing under Hampstead Heath.

Watford and Edgware Railway.

The Watford and Edgware Railway, which is an extension of the Edgware and Hampstead Railway from Edgware to Elstree, Bushey, and Watford. This railway is to be an electric surface line.

Urban Railways.

The railways in London which may be considered as strictly urban lines are:—

Metropolitan Railway—urban section.

The "Inner Circle" combined line of the Metropolitan and Metropolitan District Railways, of which the Metropolitan Railway forms the portion from South Kensington to Aldgate on the northern side of the "Circle," with stations at South Kensington, Gloucester Road, High Street Kensington, Notting Hill Gate, Queen's Road (Bayswater), Praed Street, Edgware Road, Baker Street, Portland Road, Gower Street, King's Cross, Farringdon Street, Aldersgate, Moorgate, Bishopsgate, and Aldgate.

The total number of passengers carried on the Metropolitan Company's whole system during a year is approximately 98,000,000.

Tables Nos. 68 and 69 in the Appendix show the number of passenger journeys to and from various stations on the Metropolitan Railway during the year 1903, and hour by hour on an average day. Diagram No. 94 opposite page 97 illustrates the hour to hour traffic. *Tables Nos. 68, 69.* Diagram No. 94.

Metropolitan District Railway —urban section.

The Metropolitan District Railway which runs from South Kensington to Mansion House, on the southern side of the "Circle," with stations at South Kensington, Sloane Square, Victoria, St. James' Park, Westminster Bridge, Charing Cross, Temple, Blackfriars, and Mansion House. The total number of passengers carried on the Metropolitan District Company's whole system

ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

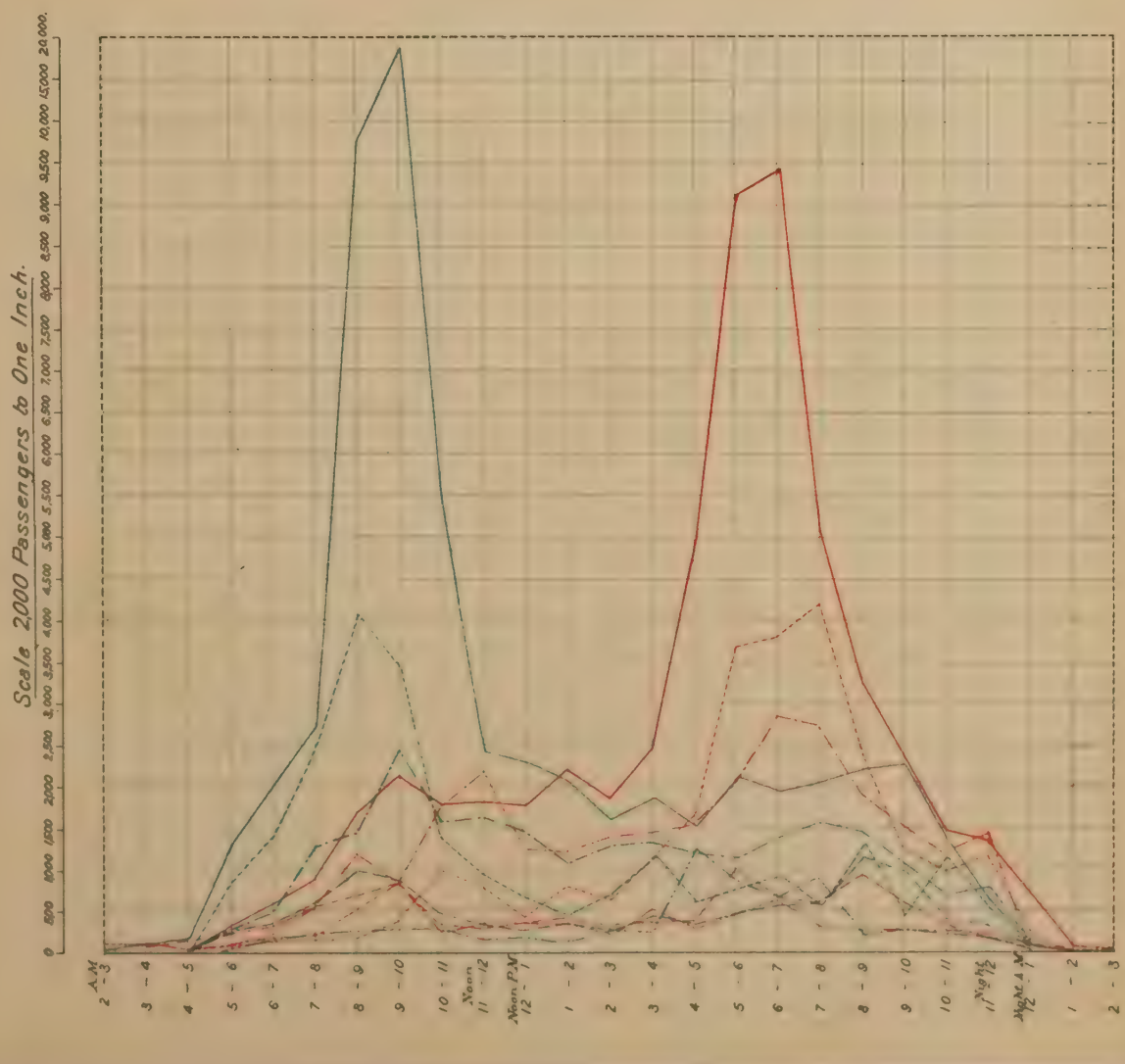
DIAGRAM SHOWING PASSENGER TRAFFIC AT STATIONS OF A TERMINAL CHARACTER WITHIN THE CENTRAL AREA OF LONDON (CONTD)

SOUTH WESTERN SECTION.

INDEX.

RED LINES SHOW DOWN TRAFFIC.
BLUE LINES SHOW UP TRAFFIC.

- WATERLOO
- VAUXHALL
- VICTORIA (L.B&S.C.RY.)
- " (S.E&C. RY)
- ADDISON ROAD



weller & Graham Ltd Litho London

during a year is approximately 55,194,000. (*See* Tables No. 68 and 69 in the Appendix; and Diagram No. 94, facing this page).

Tables Nos. 68, 69. Diagram No 94, facing.

The Metropolitan and Metropolitan District Joint Railways, which complete the "Circle" from Mansion House to Aldgate, and include a spur line to Whitechapel, in connection both with the Whitechapel and Bow Railway and the East London Railway. The stations on this section are Cannon Street, Monument, Mark Lane, and Aldgate East.

Metropolitan and District joint lines.

The East London Railway, which commences at a junction with the Great Eastern Railway near Bishopsgate, with stations at Shoreditch, Whitechapel, Shadwell, Wapping, Rotherhithe and Deptford Road, and terminates, by junctions with the London, Brighton and South Coast, and the South Eastern and Chatham Railways, at New Cross.

East London Railway.

Urban train services are provided by the London and North Western Railway between Broad Street (N.L.R.) over the North London, and London and North Western Railways *via* Willesden Junction, and the West London Joint and the Metropolitan District Railways, *via* Addison Road to Mansion House; by the London, Brighton and South Coast, and the London and South Western Railways between Clapham Junction and Addison Road, over the West London Joint, and the West London Extension Railways; by the Great Western Railway from Aldgate to Addison Road over the Metropolitan, the Hammersmith and City, and the West London Joint Railways.

Urban services.

Of the above railways the Metropolitan and Metropolitan District are now being converted from steam to electric traction.

Metropolitan and Metropolitan District Railways being converted to electric.

The following urban railways are deep-level electric "tube" lines :—

Deep-level electric "tube" railways.

The City and South London Railway, which runs from Clapham Common to the Angel, Islington, with stations at Clapham Common, Clapham Road, Stockwell, Oval, Kennington, "Elephant and Castle," Borough, London Bridge, Bank, Moorgate, Old Street, City Road, and Angel. This Company have an extension authorised from the Angel to King's Cross, St. Pancras, and Euston; and also an extension to Brixton.

City and South London Railway.

The total number of passengers carried on the City and South London Railway during a year is approximately 19,000,000.

Tables and diagrams: City and South London Railway.

Table No. 70 Table No. 70 in the Appendix shows the number of passengers entering and leaving various stations on the City and South London Railway each day, *Table No. 71* and Table No. 71 the number of passengers booked to and from all stations *Diagram No. 95.* during an ordinary week-day, and Diagram No. 95 in the Appendix shows the number of passengers travelling between each station on the up and down lines respectively during the whole of, and from 8 a.m. till 10 a.m. on, an ordinary week-day, and also shows separately the through traffic between Clapham Common, Clapham Road and Stockwell, and Old Street, City Road, and Angel, for the same periods. Diagram No. 96, opposite page 98, illus- Diagrams Nos. 96, 97 trates the traffic for a week-day, and Diagram No. 97, facing page 99, shows the hour by hour variations.

The Central London Railway, which runs from Shepherd's Bush to the Bank, with stations at Shepherd's Bush, Holland Park, Notting Hill Gate, Queen's Road, Lancaster Gate, Marble Arch, Bond Street, Oxford Circus, Tottenham Court Road, British Museum, Chancery Lane, Post Office, and the Bank. The total number of passengers carried on the Central London Railway during a year is approximately 45,000,000.

Central London Railway.

Table No. 70 Table No. 70 in the Appendix shows the number of passengers entering and leaving various stations on the Central London Railway each hour for a Diagrams Nos. 97, 98 complete day, and Diagram No. 97 and Diagram No. 98, facing pages 99 and 100, illustrate the hourly and daily traffic.

Table and diagrams: Central London Railway.

The Waterloo and City Railway which runs from Waterloo (L. & S.W.R.) to the Bank, with stations at Waterloo and the Bank. The total number of passengers carried on the Waterloo and City Railway during a year is approximately 5,400,000.

Waterloo and City Railway.

Table No. 70 Table No. 70 in the Appendix shows the number of passengers entering and leaving the termini of the Waterloo and City Railway hour by hour, and *Diagram No. 99.* Diagram No. 99, facing page 101, illustrates the nature of that traffic.

Tables and diagrams: Waterloo and City Railway.

The Great Northern and City Railway, which runs from Finsbury Park (G.N.R.) to Moorgate Street, with stations at Finsbury Park, Drayton Park, Highbury, Essex Road, Old Street and Moorgate. This railway has been

Great Northern and City Railway.

constructed with tubes 16 feet in diameter, and can accommodate the main line and suburban coaches of the Great Northern Railway. The number of passengers being carried at the present time is at the rate of 12,000,000 per annum.

Tables and Diagrams: Great Northern and City Railways.

Table No. 70 in the Appendix shows the number of passengers entering and leaving various stations on the Great Northern and City Railway hour by hour, and Diagram No. 99, facing page 101, illustrates the nature of that traffic. *Table No. 70* Diagram No. 99.

"Tube" railways in course of construction.

In addition to these, there are in course of construction the following railways, which are expected to be opened within one or two years:—

Great Northern, Piccadilly and Brompton Railway.

The Great Northern, Piccadilly and Brompton Railway which will run from Hammersmith under the District Railway to South Kensington, thence under the Brompton Road, Knightsbridge and Piccadilly to Piccadilly Circus, with an interchange station at Piccadilly Circus with the Baker Street and Waterloo Railway, thence under Coventry Street and Cranbourne Street, with an interchange station with the Charing Cross, Euston and Hampstead Railway at Cranbourne Street, thence under Long Acre and Great Queen Street to Holborn, with a branch running to the Strand, thence under Southampton Row and Russell Square to King's Cross, and under the Great Northern Railway to Finsbury Park.

Baker Street and Waterloo Railway.

The Baker Street and Waterloo Railway, which commences with an interchange station with the City and South London Railway at the "Elephant and Castle," passing under London Road and Westminster Bridge Road to Waterloo, thence under the Thames to an interchange station with the Metropolitan District Railway at Charing Cross (Embankment), and under Northumberland Avenue to Trafalgar Square, and thence under Cockspur Street and Haymarket, with an interchange station with the Great Northern, Piccadilly and Brompton Railway at Piccadilly Circus, and passing under Regent Street to Oxford Circus, and thence under Portland Place, Park Square and the south side of Regent's Park, to interchange stations with the Metropolitan and Great Central Railways at Baker Street and Marylebone, and thence under St. James' Street and Bell Street to Edgware Road and Paddington.

Charing Cross, Euston and Hampstead Railway.

The Charing Cross, Euston and Hampstead Railway, which commences with an interchange station with the South Eastern and Chatham Railway at Charing Cross, and passes under the Strand and Charing Cross Road to an interchange station with the Great Northern, Piccadilly and Brompton Railway at Cranbourne Street, thence under Tottenham Court Road and Drummond Street to an interchange station with the London and North Western Railway at Euston and under Seymour Street and High Street to Camden Town; at that point the railway forks, the north-eastern branch running under the Kentish Town Road and Junction Road to Highgate, and the north-western branch under Chalk Farm Road, Haverstock Hill and Rosslyn Hill, and Hampstead Heath to Golder's Green, where it forms a junction with the authorised Edgware and Hampstead Railway. The portion from Charing Cross under Villiers Street to the Metropolitan District Railway has not yet been undertaken.

"Tube" railways authorised but not commenced.

The following deep-level electric "tube" railways and electric surface railways have been authorised, but the construction of them has not yet been commenced.

The City and South London Railway:—"tube" railway extension from the Angel to King's Cross, St. Pancras and Euston.

The City and South London Railway:—"tube" railway extension to Brixton.

The Metropolitan District Railway:—deep-level "tube" railway from Earl's Court to Mansion House

The North West London Railway:—"tube" railway from the Marble Arch to Cricklewood.

Electric surface railways authorised but not commenced.

The Edgware and Hampstead Railway:—electric surface railway from Edgware to Hendon and Hampstead, with a junction with the Charing Cross, Euston and Hampstead Railway at Golder's Green

DIAGRAM N°96.

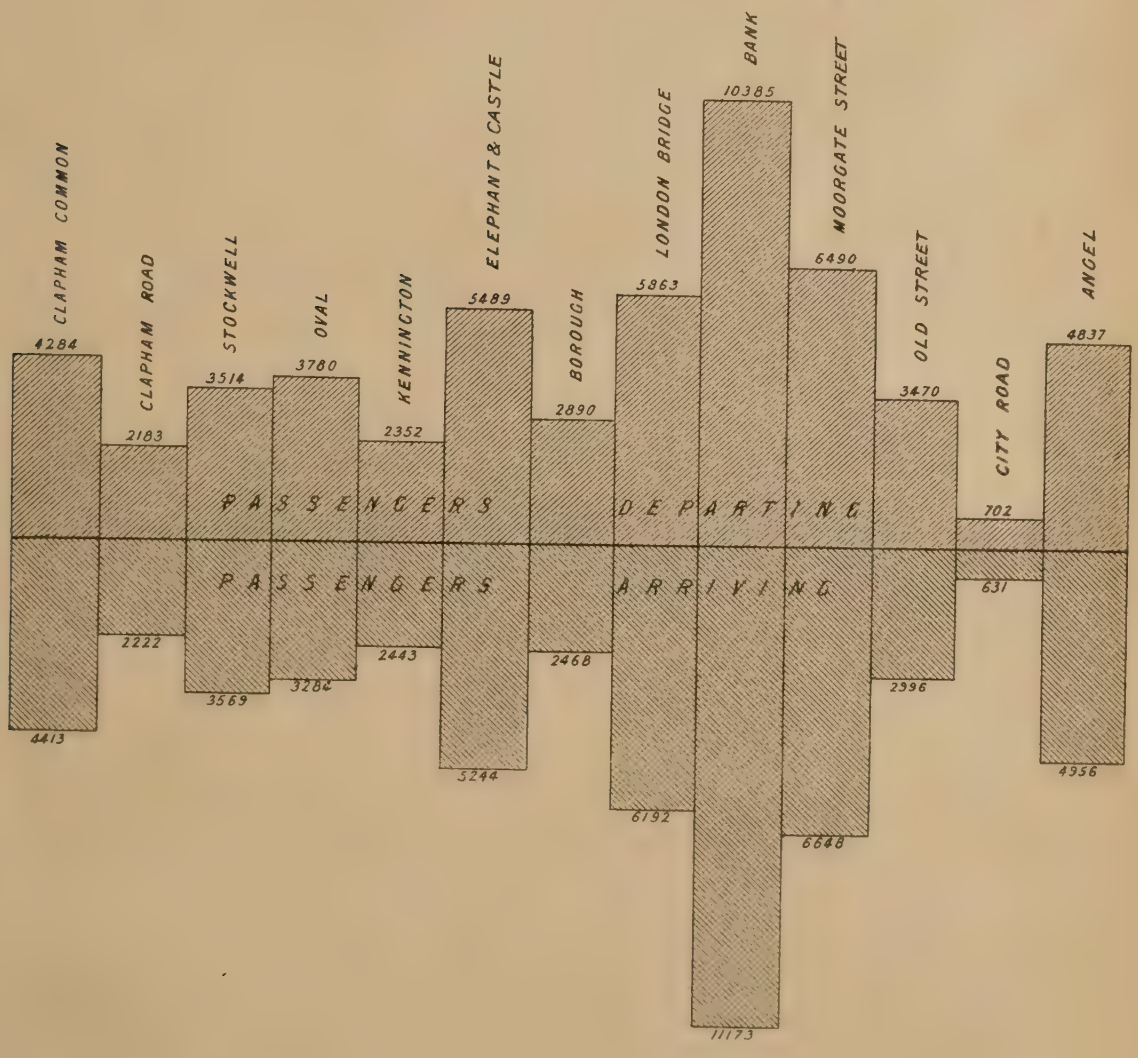
ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

CITY & SOUTH LONDON RAILWAY.

DIAGRAM SHOWING THE NUMBER OF PASSENGERS DEPARTING FROM & ARRIVING AT EACH STATION BY TRAIN DURING AN ORDINARY WEEK-DAY (FRIDAY MAY 6TH 1904.)

Vertical Scale – 4000 Passengers per Inch.



Total of Passengers Arriving by train 56,239.
Total of Passengers Departing by train 56,239.

Note. Season ticket holders included on the basis of One Up & One Down Journey per day

The Watford and Edgware Railway:—extension of the Edgware and Hampstead Railway (electric surface railway) from Edgware to Elstree, Bushey, and Watford.

Table of Mileage.

The first of the following tables—Table LII.—gives the approximate mileage, and length of single road used by passenger trains of railways in "Greater London." As some of the railways have more lines of road used by passenger trains than two, we have, in order to arrive at a common standard, given in the latter column the mileage of single road used by passenger trains. The second table—Table LIII.—shows the mileage, length of single road used by passenger trains, and number of stations of the various railways within the five sections of "Greater London" shown on the railway map (Plan No. 21, page 139) attached to this report, together with the area and population of each section. The third table—Table LIV.—gives the "tube" railways authorised and in course of construction. The fourth table —Table LV.—gives the "tube" railways and extensions authorised but not yet commenced.

Plan No. 21.

TABLE LII.

MILEAGE and LENGTH OF SINGLE ROAD used by PASSENGER TRAINS of the various Railway Companies within the area of "Greater London."

Name.	Mileage of Railway.			Length of Single Road used by Passenger Trains		
	M.	f.	ch.	M.	f.	ch.
Great Western Railway	34	2	8	92	5	3
Great Central Railway	1	7	8	3	7	6
London and North Western Railway	25	1	8	73	0	3
Midland Railway	22	2	9	74	3	0
Great Northern Railway	33	6	0	89	1	3
Great Eastern Railway	84	7	0	206	5	8
South Eastern and Chatham Railway	113	6	3	303	1	6
London, Brighton and South Coast Railway	78	3	2	216	0	9
London, Brighton and South Coast and South Eastern and Chatham Joint Railways	7	5	9	15	3	8
London and South Western Railway	76	5	6	205	6	2
London and South Western and London, Brighton and South Coast Joint Railways	6	5	1	13	2	2
London, Tilbury and Southend Railway	15	6	2	41	3	7
North London Railway	11	1	7	33	2	2
Metropolitan Extension Railway	20	5	5	41	3	0
Metropolitan Extension Railway (Great Central Widening)	7	0	5	14	1	0
Metropolitan Railway	8	3	1	16	6	2
Metropolitan Railway (Widened Lines)	2	3	7	4	7	4
Metropolitan District Railway	25	0	9	50	1	8
Metropolitan and Metropolitan District Joint Railways	2	0	1	4	0	2
West London Joint Railway	2	7	2	5	6	4
West London Extension Junction Railway	4	7	3	9	6	6
North and South Western Junction Railway	5	1	1	10	2	2
Hammersmith and City Joint Railway	3	0	0	6	0	0
Tottenham and Hampstead Railway	4	4	6	9	1	2
Tottenham and Forest Gate Railway	6	0	4	12	0	8
East London Joint Railway	4	7	0	9	6	0
Whitechapel and Bow Railway	2	0	0	4	0	0
London and India Docks Joint Railway	1	6	7	3	5	4
City and South London Railway	6	0	9	12	1	8
Waterloo and City Railway	1	4	6	3	1	2
Central London Railway	5	6	0	11	4	0
Great Northern and City Railway	3	4	0	7	0	0
Total	630	5	9	1,604	3	1

TABLE LIII.

MILEAGE, LENGTH OF SINGLE ROAD USED BY PASSENGER TRAINS, and NUMBER of STATIONS of the various Railways within the Five Sections of "Greater London" (shown on Plan No. 21, page 139) together with the Area and Population of each Section.

	"Western Section."	"Northern Section."	"Eastern Section."	"South-Eastern Section."	"South-Western Section."	Total "Greater London."
Mileage of railways	M. f. ch. 150 4 9	M. f. ch. 120 1 3	M. f. ch. 91 7 3	M. f. ch. 144 7 5	M. f. ch. 113 0 9	M. f. ch. 630 5 9
Length of single road used by passenger trains	373 5 9	313 3 4	226 1 6	393 2 6	297 5	1,604 3 1
Number of stations	120	145	90	113	90	558
Population, 1901	1,247,026	1,560,235	1,491,674	1,133,673	1,148,794	6,581,402
Number of persons per mile of railway	7,764	12,985	16,230	7,821	10,156	10,432
Number of persons per mile of single road used by passenger trains	3,337	4,978	6,595	2,882	3,859	4,102
Number of persons per station	10,392	10,760	16,574	10,032	12,764	11,794
Areas of sections, 1901, in square miles (excluding inland water, tidal water, and foreshore)	170·67	151·48	105·35	144·33	114·47	686·30
Number of miles of railways per square mile	0·941	0·793	0·872	1·004	0·988	0·919
Number of miles of single road used by passenger trains per square mile	2·18	2·06	2·14	2·72	2·60	2·34
Number of stations per square mile	0·703	0·957	0·854	0·782	0·786	0·813

TABLE LIV.—"TUBE" RAILWAYS AUTHORISED AND IN COURSE OF CONSTRUCTION.

NAME.	Length.	Length.
	M. F. CH.	M. F. CH.
Baker Street and Waterloo	5 3 5·70	
Charing Cross, Euston and Hampstead	8 0 5·96	
Great Northern, Piccadilly and Brompton	8 2 2·00	
Metropolitan District Railway, Hammersmith to Glidden Road Junction	0 4 8·00	
Total	22 3 1·66	22 3 1·66

TABLE LV.—"TUBE" RAILWAYS AND EXTENSIONS AUTHORISED BUT NOT YET COMMENCED.

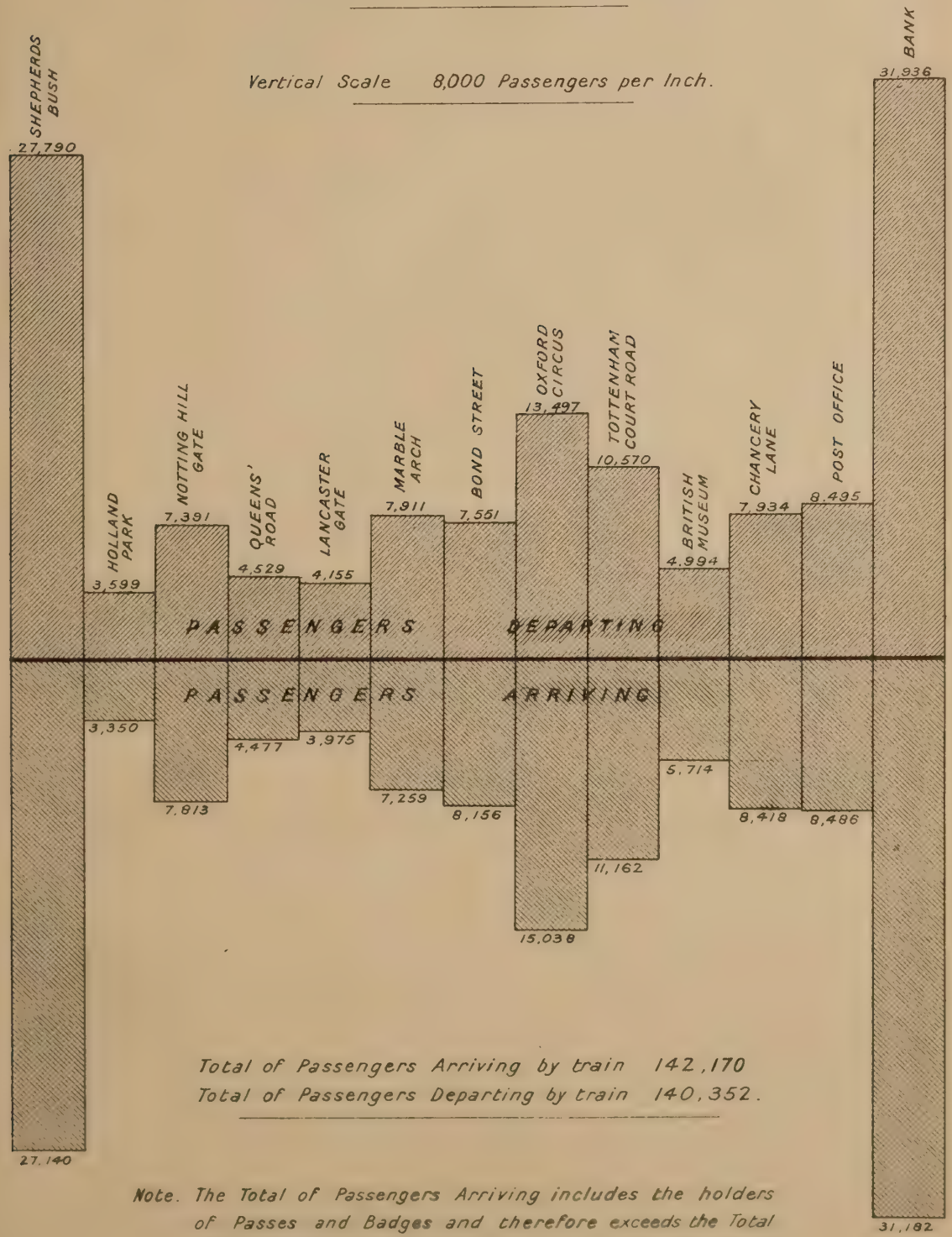
NAME.	Length.	Length.
	M. F. CH.	M. F. CH.
Great Northern, Piccadilly and Brompton :—Holborn to the Strand	0 2 8·00	
Metropolitan District Railway—Deep-Level:—Earl's Court to Mansion House	4 6 9·71	
City and Brixton :—Kennington Park to Brixton	1 5 0·85	
Edgware and Hampstead	4 4 3·00	
North-West London	4 1 0·90	
Watford and Edgware	6 1 7·10	
City and South London	1 5 9·40	
Total	23 3 8·96	23 3 8·96
Total mileage of "Tube" Railways and Extensions Authorised but not yet Opened		45 7 0·62

ROYAL COMMISSION ON LONDON TRAFFIC.

REPORT OF ADVISORY BOARD.

CENTRAL LONDON RAILWAY.

DIAGRAM SHOWING THE NUMBER OF PASSENGERS DEPARTING FROM & ARRIVING AT EACH STATION BY TRAIN DURING AN ORDINARY WEEK-DAY (WEDNESDAY FEBRUARY 18TH 1903.)



Total of Passengers Arriving by train 142,170
Total of Passengers Departing by train 140,352.

Note. The Total of Passengers Arriving includes the holders of Passes and Badges and therefore exceeds the Total of Passengers Departing which only includes the actual number of tickets given up at the Barriers.

5104 505

Weller & Graham, Ltd Litho London

If we consider Table LIII. from the point of view of railway accommodation in each of the five sections into which we have divided "Greater London," Table LVI. represents the order of priority in which those sections stand in relation to the various matters which we have classified as items of railway accommodation :—

TABLE LVI.

	1	2	3	4	5
Length of single road used by passenger trains.	"South-Eastern Section."	"Western Section."	"Northern Section."	"South-Western Section."	"Eastern Section."
Number of stations.	"Northern Section."	"Western Section."	"South-Eastern Section."	"South-Western Section."	"Eastern Section."
Number of persons per mile of single road used by passenger trains.	"South-Eastern Section."	"Western Section."	"South-Western Section."	"Northern Section."	"Eastern Section."
Number of persons per station.	"South-Eastern Section."	"Western Section."	"Northern Section."	"South-Western Section."	"Eastern Section."
Number of miles of single road used by passenger trains per square mile.	"South-Eastern Section."	"South-Western Section."	"Western Section."	"Eastern Section."	"Northern Section."
Number of stations per square mile.	"Northern Section."	"Eastern Section."	"South-Western Section."	"South-Eastern Section."	"Western Section."

Number of stations in City of London, etc.

When the lines under construction are finished, there will be 30 railway stations in the City of London, about 300 in the Administrative County of London, and about 600 in "Greater London."

The City will have one railway station for every 22 acres, the Administrative County of London one for every 249 acres, and "Greater London" one for every 739 acres.

Main-line termini.

It will be seen that the main-lines reach London by 16 termini, of which 4 are situated within the limits of the City proper.

Large sums spent on termini.

The termini of the various trunk lines have been open for very many years and the owning companies are still engaged in spending large sums of money in extending their terminal accommodation, chiefly to keep pace with suburban traffic.

Termini for suburban passengers.

It will be seen that suburban passengers have 21 terminal stations, of which 8 are situated within the limits of the City proper, thus reaching without undue inconvenience one "point of ultimate destination," while those using the suburban termini at Paddington, Baker Street, King's Cross, Moorgate, Liverpool Street, Cannon Street, Charing Cross and Victoria, are in close connection with the Metropolitan and Metropolitan District Railways, and Waterloo has its own "tube" service to the Bank station of the Waterloo and City Railway.

Disadvantage of having termini for suburban passengers.

When the present main-line railways were built, and their terminal stations located, the traffic then in sight consisted chiefly of main-line long-distance traffic, and the enormous mass of suburban traffic since developed was unthought of. We elsewhere point out the great disadvantage that arises from having termini for suburban or urban traffic, not only on account of the inconvenience to the passenger by being tied to one particular spot in a vast city, but also on account of the serious loss of time caused by working a "shuttle" system of trains in a crowded terminus, and the lowering thereby of the capacity of the line, and of its dividend earning power.

Through routes north and south insufficient

Of the present suburban systems, there are few, with the exception of the Metropolitan and Metropolitan District Railways, which have any continuous route through "Greater London," much used for through running. Physically speaking, many of them have means of through running, as most, if not all, of them are connected, more or less directly, with the South Eastern and Chatham Line, *via* Ludgate Hill, through the centre of London, or with the West London line at the west, or the East London line at the east, but it is obvious that these junction

lines are insufficient as through routes for many of the great suburban services of a large number of railways.

Through routes east and west.

In addition to these joining lines north and south, the main-line railways are connected east and west by the North London and Tottenham and Hampstead and the Tottenham and Forest Gate Railways north of the Thames, and by the South Eastern and Chatham and the London, Brighton and South Coast Railways south of the Thames.

Insufficient through routes to relieve terminal stations.

But the mere fact of so many railways having only three through north and south connecting lines militates against any general system of through communication with such frequency in the number of trains as would relieve any one company from being obliged mainly to deal with its suburban traffic at its own main-line terminus. Thus, for the main-line companies, practically speaking, their services of suburban trains arrive at their termini and depart thence on their return journeys, though all, or nearly all of them, have some sort of through communication from one boundary of London to its opposite boundary.

Object to be aimed at is through running.

We are of the opinion that the object to be aimed at in suburban traffic is through running to termini outside "Greater London," and for urban traffic to termini outside the "Central Area." If this be impracticable efforts should be made in the direction of the abolition, by means of loops, of cross-shunting at the termini.

Metropolitan and Metropolitan District Railways through east and west services.

The system of working suburban traffic or semi-urban traffic, which we consider the best for the needs of the Metropolis, may be illustrated by the services of trains run by the Metropolitan District Company from Wimbledon, Ealing and Richmond, through the southern portion of the "Inner Circle" Railway, and terminating at East Ham on the London, Tilbury and Southend Railway, and the similar services between New Cross and the west; also by the services run by the Metropolitan Company from Richmond, passing through the northern portion of the "Inner Circle," and terminating at New Cross.

Through running preferable to circular running.

It has been given in evidence before the Royal Commission that the "Inner Circle" of the Metropolitan and Metropolitan District Railways, as a circular railway has not been a financial success—the chief traffic being from east to west—and that the completion of the "Circle" is mainly useful in affording convenient connecting lines between the northern and southern sections of these two railways.

Suggested extensions to get through running.

Through running might be provided on the Baker Street and Waterloo, the Charing Cross, Euston and Hampstead, the Great Northern, Piccadilly and Brompton, and the City and South London Railways, if they were extended further, both in a northerly and southerly direction, and on the Central London Railway if extended in an easterly and westerly direction. By such means, or by the forming of loops, the disadvantages of termini for these routes would be avoided in the "Central Area."

Additional railways dependent on new streets.

The question of additional railway accommodation for London is intimately dependent upon the decision which may be come to as to the more pressing requirement of new and widened streets and tramways. If new and important streets, such as the "Main Avenues" which have been discussed, be formed in the future, it may reasonably be assumed that the subsoil will be utilised in some way for railway purposes, and that surface tramways will also be made. On the other hand, in the case of existing streets of sufficient width to admit of tramways, or of partially widened streets, it would probably be found in the great majority of instances that the tramway alone would sufficiently meet the requirements of the case, and that the great cost of the railway or tramway subway underneath the street need not be incurred, at least for strictly urban traffic.

Financial results.

Having regard to the poor financial results so far attained by railways for the relief of London traffic, it is a matter both of surprise and satisfaction to find that London is already by no means badly supplied with such railways, and that the latter have been carried out by private enterprise alone without any assistance from the rates. It would be still more satisfactory if any reasonable hope could be held out that similar enterprise will continue in the future, as the railway problem might then be dealt

with independently of the question of possible new streets, and would be a comparatively simple one.

Underground railways do not relieve street traffic.

There can be little doubt that the construction of new streets and the widening of others has been put off from time to time in the past, with the resultant present congestion of traffic, because it was hoped that underground railways, made by private enterprise, would effectually relieve the street traffic, and thus save the ratepayers the burden of making costly street improvements. Unfortunately, experience has shown that underground railways, although of immense public service within their own limits, do not relieve street congestion, and offer no alternative to street widenings. It is unnecessary to labour this point, as everyone can see it for himself in Oxford Street, Euston Road, and other places under which underground railways exist.

Can railways be extended without ratepayers assistance ?

The question whether, even if underground railways did relieve the traffic, they could be materially extended without assistance from the ratepayers in some form is of such importance that, before entering further on the subject of new railways for London, it requires to be discussed in some detail. It is obviously one thing to advise that a railway should be made of a certain type, and in a certain general direction, if some company can be formed to undertake to make it, and another thing to say that ratepayers' money, which is imperatively needed for new streets, should be devoted to the making of new railways.

Financial experiences of the past.

In considering the question of additional railways, therefore, it is first necessary to see whether there is really any reasonable probability of any extensive system of future "tubes" or "shallow" subways being carried out by private enterprise in the near future, and, to do this, it is necessary to refer to the experience of the past. This shows that, as regards finance, the building of the present railways has been accomplished only with great difficulty, and that these difficulties are far greater now than in earlier days, owing to increased prices of labour and material, increased cost of property, and the more onerous clauses that have been imposed upon railway companies by Parliament, often on the application of local authorities, who, it might be thought, would have helped, rather than impeded, the construction of railways, especially in the view then held that railways would render costly street improvements unnecessary. As a matter of fact, the Corporation of the City of London has alone taken the latter view of its duty as representative of the public interests.

History of Metropolitan Railway finance.

It is exactly 50 years since the Metropolitan Railway obtained an Act of Parliament for a railway from Paddington to the General Post Office, and the Directors in their report to the shareholders, dated August, 1855, remarked: "During the late session of Parliament, the overcrowded state "of the leading thoroughfares and the consequent obstruction of the great "lines of communication occupied much public attention, and a Select "Committee of the House of Commons was appointed to consider and report "on the subject. The Directors claimed that the Metropolitan Railway "was the most practicable of the schemes submitted for relieving the con- "gestion, and anticipated a speedy and profitable completion of their "undertaking."

Four years later the Directors had to report that the capital had not been subscribed; that although they had been convinced that "the citizens "of London would not prove so deaf to the earnest appeal of Mr. Pearson, "the City Solicitor, or so blind to the commercial features of the under- "taking, as to lose the opportunity now afforded them of accomplishing so "large an amount of public good combined with the prospect of so much "pecuniary advantage to themselves," yet the result of this special appeal was merely a subscription of £50,000, and the Directors consequently deposited a Bill in Parliament for the abandonment of the undertaking.

Before finally abandoning the railway, however, the Directors made a last appeal to the Corporation of London itself, and to quote the words of the Directors' report, "that influential body, after a careful investigation "into the merits and position of the Company, consented to become "shareholders to the extent of 200,000*l.* upon condition that, within a

"limited period the entire 850,000*l.* share capital of the Company should "be *bonâ fide* taken up and paid upon." The Great Western Railway Directors had, in a previous report to their shareholders, referred favourably to the passing of the Act authorising the Metropolitan Railway, and informed them that, under certain conditions, they had undertaken to contribute 175,000*l.* to the capital for making it, and that, as regards the expenses incurred in the movement and carting of goods alone, the actual saving to the Great Western Railway would probably exceed the interest upon the money proposed to be subscribed. They added "that it "was fully believed, however, that so large a traffic would be obtained upon "the line itself as to render it a profitable investment independently of its "collateral advantages to the Great Western Railway system of Railways."

At last, therefore, after six years' negotiations and modifications of plans, the Metropolitan Railway (the first of the now so-called "shallow" railway lines) was enabled to proceed, solely through the public spirited venture of the Corporation of London at one end of the line, and of a powerful railway company at the other end, which, in addition to their subscription, undertook to work the line on favourable terms, and so save the equipment expenses.

"Inner Circle" completion.

Another example in which the co-operation of public bodies enabled a work very valuable to London to be undertaken, which without such help would have been impossible, was the completion of the "Inner Circle" Railway from the Mansion House to Aldgate.

In that case the scheme for the railway was connected with a proposal for the much needed widening of Eastcheap and Great Tower Street and for a new street to Tower Hill, and the Corporation of London and the Metropolitan Board of Works agreed with the Metropolitan and Metropolitan District Railway Companies that, if the two companies would widen the streets in question, and make a new street (the railway being at the same time constructed beneath the streets), the two public bodies would subscribe £800,000 to the undertaking. It is not too much to say that, but for that help, the capital required for the completion of the "Inner Circle," by the extension of the Metropolitan District Railway eastward of the Mansion House Station, could not have been found, as it would have been beyond the means of the two companies to have purchased the properties required for the railway, in the streets which were widened, or on the site of the new street.

Cost of Metropolitan Railway between Paddington and the City.

Owing to the great difficulty in raising the money for the original Metropolitan Railway the utmost economy was exercised, both as regards works and land, and the total cost of the railway between Paddington and the City was, in round figures, 300,000*l.* per mile, of which 186,000*l.* was for works, 114,000*l.* for land, Parliamentary and other expenses. This 300,000*l.* per mile was for a subway 28 ft. 6 in. wide, for the broad-gauge rolling stock of the Great Western Railway, as compared with the 20 feet tramway subway which Mr. Fitzmaurice estimated[1] at amounts ranging from about 230,000*l.* to 833,000*l.* per mile without equipment, or[2] the "much greater" cost if provision were made, so that there "would be very little "interference with the ordinary traffic." In the case of the original Metropolitan Railway, the local authorities and the public put up with very great interference of traffic which would never be suffered again, and, apart from that circumstance, the rise of prices in both works and land has been enormous. Thus, comparing the contract prices, in the case of the Metropolitan Railway, 44 years ago with Mr. Fitzmaurice's subway prices, we have :—

Rise in prices of land and works.

	1860.		1904.	
	s.	*d.*	*s.*	*d.*
Excavation carried to spoil - - - -	4	0	7	6
Brickwork - - - - - - -	24	0	50	0
Concrete - - - - - - -	7	6	16	0

It will be seen at once, therefore, that as land has certainly increased in as high a ratio as materials, it is no matter for surprise that the difficulty in finding money for underground railways, which would have been fatal to the Metropolitan Railway had not the Corporation of London and the Great

[1] Mr. Maurice Fitzmaurice, Q. 6469, Vol. II.
[2] Mr. Maurice Fitzmaurice, Q. 6472, Vol. II.

Western Railway come to the rescue, and fatal also to the completion of the "Inner Circle" but for the aid of the public bodies, has been an increasing one; and that promoters of independent lines of railways, as distinguished from extensions of existing subway lines, were driven to the "tube" system, notwithstanding its admitted inferiority to the "shallow" subway system, because of the lower estimated cost and less interference with antagonistic local authorities.

Difficulty a purely financial one.

In considering the question of future railway accommodation, it cannot be too frequently urged that the difficulty in the past has been, and still remains, a purely financial one. As Mr. Fitzmaurice remarks[1]: "there "is no engineering difficulty in constructing a "shallow" subway under the "Strand, or even under Piccadilly, in fact it could be constructed so that "there would be very little interference with the ordinary traffic, but the cost, "if such a method were adopted, would be much greater." The practicability of so doing the work was proved by the construction of the Bank Station of the Central London Railway, and of the Metropolitan and Metropolitan District Railways extension under Cannon Street, Eastcheap, Minories, and Whitechapel Road, as also of the Glasgow Central Railway through the heart of Glasgow. Under the junction of Mansion House Street, Queen Victoria Street, Cornhill, and adjoining streets, the busiest centre of road traffic probably in the world, where, during some hours of the day, an omnibus passes every 3·7 seconds, and a vehicle of some kind every 1·4 seconds, the Bank Station with lifts, booking offices, and public subways was constructed, without any appreciable interference with the traffic, the whole of the works, including sewers, gas, and water mains, being executed and diverted under cover of the original asphalt roadway. The actual prices of the work, as shown by the audited books, generally confirms Mr. Fitzmaurice's estimate for a shallow "subway" through the Strand and City. To compare the latter with the cost of completed electric railways, it is necessary, of course, to add to Mr. Fitzmaurice's estimate the cost of generating station, electrical equipment, and Parliamentary and other charges, interest during construction, working capital, and contingencies, so that the capital for a "shallow" subway, with stations half-a-mile apart, through such places as the Strand or City, would have to be about a million a mile, or greater than that required for a "tube" railway. We do not mean, however, that the average cost of a "shallow" railway partly through the City, and partly through less difficult parts of London, need be so high.

Cost of underground railways, "tube" railways, and tramway subways.

The cost of various railways for a double line of rails, including stations, as given in evidence before the Royal Commission, is as follows :—

[1] Mr. Maurice Fitzmaurice, Q. 6484, Vol. II.

COST OF VARIOUS RAILWAYS FOR A DOUBLE LINE OF RAILS, INCLUDING STATIONS, AS GIVEN IN EVIDENCE BEFORE THE ROYAL COMMISSION.

Table LVII.

"SHALLOW" RAILWAYS.

Evidence. Question Number. Vol. II.	Name of Witness.	Name of Railway.	Cost per Mile.
		Metropolitan Railway.	£
24505	Mr. A. C. Ellis	Aldgate to South Kensington *via* Baker Street	774,896
24505	ditto	Aldgate North Curve	1,054,728
		Metropolitan District Railway.	
19569	Mr. R. W. Perks, M.P.	Mansion House to High Street Kensington	839,531
19573	ditto ditto	Mansion House to Brompton	665,000
19573	ditto ditto	West Brompton to Addison Road	223,000
19574	ditto ditto	West Brompton to Putney Bridge	212,000
19573	ditto ditto	Warwick Road to Hammersmith	222,000
19573	ditto ditto	Junction South Western Railway, Shaftesbury Road	736,000
19574	ditto ditto	Turnham Green to Ealing Broadway	98,000
19574	ditto ditto	Ealing and South Harrow	51,000
19574	ditto ditto	Hounslow and Metropolitan	54,912
		M. and M.D. Railways, City Lines and Extensions.	
24505	Mr. A. C. Ellis	Mansion House to Aldgate	1,108,838
19574	Mr. R. W. Perks, M.P.	Mansion House to St. Mary's	937,564
23633	Mr. C. A. Brereton	Mansion House to Aldgate	* 532,000
23640	ditto ditto	Aldgate to St. Mary's	* 301,000
19574	Mr. R. W. Perks, M.P.	East London Spur	1,283,000
		Whitechapel and Bow Railway.	
19753*	ditto ditto	Whitechapel and Bow Railway	745,646
23641	Mr. C. A. Brereton	ditto ditto	* 430,000
		Glasgow Central Railway.	
23742	ditto ditto	Glasgow Central Railway	* 308,000

* Cost of Construction only.

TABLE LVIII.

"TUBE" RAILWAYS.

Evidence, Question or Appendix Number.	Name of Witness.	Name of Railway.	Length.	Capital.	Cost per mile.
			m. f. chs.	£	£
Table I. App. No. 3, Vol. III.	Mr. W. H. Dickinson -	City and South London - - - - -	6 7 0·75	2,598,000	377,200
Ditto -	- - ditto - -	Central London - - - - - - -	6 5 1·92	4,200,000	631,600
Ditto -	- - ditto - -	Great Northern and City - - - -	3 7 0·42	3,113,000	803,360
Ditto -	- - ditto -	Baker Street and Waterloo - - -	5 3 5·7	3,179,000	583,230
Ditto -	- - ditto - -	Charing Cross, Euston and Hampstead -	8 0 5·96	5,768,000	714,320
Ditto -	- - ditto - -	Waterloo and City - - - - - -	1 4 6·80	720,000	453,520
Ditto -	- - ditto - -	Great Northern, Piccadilly and Brompton -	7 0 7·10	6,433,000	907,680
Ditto -	- - ditto - -	Estimate for Metropolitan District Deep Level.	4 6 9·71	1,600,000	328,240
Q. 14197 Vol. II.	Sir Douglas Fox -	General Estimate - - - - - - -	1 0 0	500,000	—
Ditto -	- - ditto - -	General Estimate Works and Equipment -	1 0 0	—	400,000
Statement A. App. No. 59, Vol. III.	Mr. R. Elliott Cooper -	Estimate of Proposed Hammersmith, City and North East London Railway.	19 5 9	*7,850,837	397,733
Ditto -	- - ditto - -	Detail single line - - - - - - -		—	100,259	298,468
Ditto -	- - ditto - -	,, Hammersmith to Piccadilly - - -		—	1,889,153	444,501
Ditto -	- - ditto - -	,, Piccadilly to Monument - - -		—	1,987,146	848 966
Ditto -	- - ditto - -	,, Monument to Stoke Newington - -		—	1,510,571	406,888
Ditto -	- - ditto - -	,, Stoke Newington to Tottenham Green		—	638,419	321,295
Ditto -	- - ditto - -	,, Tottenham Green to Palmer's Green -		—	466,334	179,533
Ditto -	- - ditto - -	,, Stoke Newington to Upper Clapton -		—	282,034	317,500
Ditto -	- - ditto - -	,, Upper Clapton to Walthamstow- -		—	976,921	269,433
Q. 6472 Vol. II.	Mr. M. Fitzmaurice, C.M.G.	Estimate (Section A) Hammersmith to Piccadilly.		—	†350,000
Ditto -	- - ditto - -	Estimate (Section B) Piccadilly to Bishopsgate.		—	†465,700
Ditto -	- - ditto - -	Estimate (Section C) Bishopsgate to County Boundary.		—	†365,500

The diameter of the "tubes" of the Great Northern and City is 16 feet; City and South London, 10 ft. 6 in.; Waterloo and City, 12 ft. 1¼ in.; and all the others, 11 ft. 8¼-in.

* Total Works, Land and Equipment.

† Works and Land for Stations.

TABLE LIX.

"SHALLOW" TRAMWAYS (TRAMWAY SUBWAYS).

Evidence. Question Number, Vol. II.	Name of Witness.	Name of Street.	Cost per Mile.
			£
6237	Mr. M. Fitzmaurice, C.M.G. -	Kingsway - - - - - - - - - - -	395,000
6469	- ditto - - ditto -	Estimate, Hammersmith to Piccadilly - - - - - -	229,892
6469	- ditto - - ditto -	,, Piccadilly to Bishopsgate - - - - -	833,106
6469	- ditto - - ditto -	,, Bishopsgate to County Boundary -	446,756

The above estimate includes pipe subways, but not street decking.

Reliable estimates would necessitate detailed estimates.

Mr. Fitzmaurice's figures show that the cost of a "shallow subway" for tramcars with small, unimportant stations, in new streets, or even in some existing streets where the traffic could be temporarily diverted, and the sewers and pipes are few, would be less than that of an ordinary "tube" railway, so that the advantages of the former and the lower cost of working it without lifts could be secured. The question thus is one of detailed estimate under particular conditions, and no general law can be laid down as to the relative costs of "tubes" and "shallow" subways for railways or tramways, nor could any type, plans of stations, showing the means of ingress and egress, be prepared, as the conditions vary at each site, and, moreover, the Board of Trade already control the underground arrangements, and the London County Council those at street level.

Extensions of parent lines.

The parent "shallow" subway line (the original Metropolitan Railway) was only $3\frac{3}{4}$ miles long, and as it cost only about 300,000*l.* a mile, it was a financial success when opened. Thus it was possible to find money for its eastern and western extensions, and also to a certain extent for its associated line in the "Circle"—the Metropolitan District Railway. Practically everything that has been done in London in the way of "shallow" subway railways may be regarded as extensions of the Metropolitan and Metropolitan District Railways, and not as original lines dependent upon their own financial merits. The extensions cost far more than the 300,000*l.* per mile of the original Metropolitan Railway, for various reasons. One very important cause was that, partly on account of the necessity for better ventilation of the line, by reason of the use of steam locomotives, and partly to avoid obstruction of street traffic, Parliamentary Committees favoured the construction of lines through private property, where open cuttings could be obtained at stations and intermediate points to promote ventilation.

Cost of "Inner Circle."

Mr. A. C. Ellis, the General Manager of the Metropolitan Railway, in his evidence[1] before the Royal Commission, states that the "Inner Circle" was very expensive as regards cost of land and construction. "The "section from Aldgate to South Kensington" (which includes the cheap part of the original line) "*via* Baker Street cost at the rate of 774,896*l.* per "mile." The other portions in the City were more expensive. "The Aldgate "North curve," which is only 242 yards in length, "cost at the rate of "1,054,728*l.* per mile, and the "Inner Circle" part of the Eastern Joint Lines "at the rate of 1,108,838*l.* per mile."

£1,000,000 per mile.

The short lengths of railway, to which the cost of over one million a mile apply, were in many respects exceptional, but, however that may be, it will be seen, on the basis of the above figures, and of Mr. Fitzmaurice's estimates, that the extra cost of carrying out the works of a "shallow" railway with large stations, under a street that has such heavy traffic as the Strand or Piccadilly, would be approximately £1,000,000 a mile, including generating stations and equipment, so that there is no escape from the conclusion that such lines cannot be made on a commercial basis as independent undertakings by private enterprise.

Such lines cannot be made on commercial basis

Relative cost of "shallow" and "tube" railway

As the question of the relative cost of "shallow" and "tube" railways is important, we think it well to refer to it in some detail, as the consideration of it is not free from difficulties owing to varying statements on the subject.

The original "tube" railways were made for a capital cost of between £350,000 and £450,000 per mile, but the sizes of the "tubes" and stations have been increased, and, in various ways, the capitals of various "tube" lines have so grown that the general trend of evidence is that any "tube" railway in the present or future must be estimated at from £650,000 to £900,000 per mile, including interest during construction, electrical generating station, equipment, land, compensation, and general expenses. We have not got the necessary information to give figures for "shallow" railways quite on all fours with those of the cost of the completed and equipped "tube" railways, but the various prices per mile of the "shallow" railways which have been given in evidence are, so far as they go, instructive. Mr. Ellis,[1] as we have seen, gave the cost of the Metropolitan Railway from Aldgate to South Kensington as £774,896 per mile, and Mr. Perks[2] stated that the cost of the Metropolitan District line from the Mansion House to West Brompton was £665,000 per mile, of which £284,000 per mile was

[1] Mr. A. C. Ellis, Q. 24505, Vol. II.
[2] Mr. R. W. Perks, M.P., Q. 19573, Vol. II.

for lands and compensation.[1] Both these rates per mile appear to comprise everything except equipment, and, as we know, include a very large amount of land for stations and ventilation and a considerable amount of surplus land. Prices of labour and materials and of land have risen very considerably since these lines were opened in 1871, probably to the extent of 25 per cent. This would bring the present cost of the lines in question to about £1,000,000 a mile. But, in comparing these lines with a "shallow" line of the future, the question of the expenditure on land, and compensation for open stations, and ventilation assumes a position of much importance, as these large items of expense will be much lessened on any electric railway. Mr. Ellis[2] gave the total cost of the completion of the "Inner Circle" through the heart of the City as £1,108,838 per mile. Now, we know from Mr. Brereton's evidence[3] that the cost of the works of the "Inner Circle" completion, including those of the new streets and street widenings, was £532,000 per mile, with three very expensive stations on a total length of line of only 1 mile 7 chains; or under £440,000 per mile without stations.

Thus, it would appear that land, compensation, law, engineering, surveyor's charges, and other expenses, much of which would be connected with the acquisition of land, must have cost £576,838 per mile, or approximately the same as the cost of the works.

Again,[3] the cost of the works of the line from Aldgate to Whitechapel, made at the same time, was £301,000 per mile with one large station at Aldgate East on a length of 42 chains, or £270,000 per mile without the station. We have not the figures of the cost of land and other matters per mile on this length of line, but it certainly must have been very much less than on the length from Mansion House to Aldgate.

The average cost of the "Inner Circle" completion line including its extension to Whitechapel, a total length of 1 mile 54 chains, and including land and all costs, after deducting the contribution of the local authorities (£800,000) and the value of surplus lands (£840,000), as given by Mr. Perks,[1] amounted to £937,564 per mile. To all the above figures of the cost of works of the "Inner Circle" completion lines, about 20 per cent. should be added for the rise in prices of labour and materials to arrive at what they would cost now.

Coming nearer to the present time, the cost of the works on the Whitechapel and Bow Railway,[3] recently finished, which is 2 miles 4 chains in length, was £430,000 per mile with stations, and £350,000 per mile without stations. The total capital cost of the Whitechapel and Bow Railway[1] was £745,646 per mile, so that land, compensation, and other costs came to £315,646 per mile. The cost of the works of the Glasgow Central Railway, made in 1892, the urban portion of which is about 4½ miles in length, was about £386,000 per mile for that section including sewers constructed by the Corporation of Glasgow but paid for by the railway company, and with unusually large and costly stations, which added about £100,000 to the average cost per mile. The cost of the lands and properties, if added, brings up the average cost per mile of the urban portion of the Glasgow Central Railway to £562,400.

In all the cases above referred to, there were very heavy expenses in diverting sewers and pipes and tramways, and in underpinning adjoining properties; and, in each case, the lines were constructed under platforms which permitted of the street traffic being maintained without interruption during the building of the railway. In consequence of these platforms, Mr. Fitzmaurice stated that, the cost of a "shallow" railway would be greatly increased.

We are quite aware that the above figures of cost, however valuable in themselves, do not exhaust the subject of a comparison between "shallow" and "tube" railways, both worked electrically. For such a purpose, the cost of an electric generating station and equipment should, on the one hand, in the case of each of the above railways be added; while, on the other hand, stations for an electric "shallow" railway would be very considerably less expensive than for one worked by steam locomotives, not only in works, but, more importantly, in land and compensation, with the attendant costs.

[1] Mr. R. W. Perks, M.P., Qq. 19752, 19574, 19753, Vol. II.
[2] Mr. A. C. Ellis, Q. 24505, Vol. II.
[3] Mr. C. A. Brereton, Qq. 23633, 23640, 23641, Vol. II.

It would appear, as a broad result, that the works alone of "shallow" railways, on an average, between the most expensive parts of London, and such parts as Whitechapel and Bow has come to between £455,000 and £505,000 per mile, including equally numerous and commodious stations to those on existing railways; that the cost of land per mile has varied very greatly, not only with the locality, but with the size and number of the stations, and has been between £300,000 and £420,000; and that the cost of "shallow" railways has, up to now, been much augmented by the necessity for ventilation in connection with the use of steam locomotives. Lastly, in making any comparison with the expenditures per mile on "tube" railways, it should be always remembered that the cost of working the lifts and lighting the stations, together with other matters for "tube" lines, adds largely to the working expenses, and should be capitalized against the "tube" system in making comparisons.

Ever-increasing cost of construction and refusal of public to subscribe.

The experience of the past 40 years, as regards railways of the Metropolitan type, may be summed up as an ever-increasing cost of construction; a persistently maintained refusal on the part of the public to find the money for any new line, which was not practically an extension of an existing railway or guaranteed by one; and dividends which were very disheartening. For example, the last dividend paid by the Metropolitan District Company on its open capital was in 1882 and then of only 7s. 6d. per cent. per annum, while now, it cannot nearly meet the whole of its preference charges. The Metropolitan Company is in a better position, but chiefly from suburban extensions. Its present dividend on its open stock is 3 per cent.

Origin of "tube" railways.

It was this deadlock which as we have said drew the attention of promoters to "tube" railways. Engineers were familiar with the system; for, only two years after the opening of the Metropolitan Railway, a short length was constructed at Sydenham, and thousands of people took trips upon it. There were obvious disadvantages, however, connected with the small tubes, and engineers generally reserved the system as a last resort, should the more convenient "shallow" subway type of railway prove impracticable from a financial point of view.

Mr. Peter Barlow and Mr. Greathead.

There was one engineer, however—Mr. Peter Barlow—who foresaw, as early as 1867, that the "tube" system would have to be resorted to, and he published a pamphlet that year "On the Relief of London Street Traffic," advocating the present iron-tunnel shield-driven system. The late Mr. Greathead, an engineer who had been associated with Mr. Barlow in the construction of a small subway for foot-passengers, beneath the Thames west of the Tower, further developed the idea, which promised cheapness, good ventilation, and no interference with streets or private property. Notwithstanding the support afforded by the Press to the proposal, nothing practically was done owing to the usual financial difficulties until Mr. C. Grey Mott, the present Chairman of the City and South London Railway Company, following the successful example of Mr. Pearson, the City Solicitor, in the case of the original Metropolitan Railway, devoted all his energies to obtaining the support of City men, and finally in 1884 an Act was obtained for a "tube" railway between the City and the "Elephant and Castle," with the modest capital of 300,000*l.*, the Parliamentary estimate for works and land being 150,000*l.*, and the balance representing equipment and general charges. Upon this experiment, practically all succeeding "tube" railways in every country have been based. As regards the pioneer railway itself, now the City and South London Railway, it has grown to a length of 6·8 miles, with a capital of about 2,598,000*l.*, which represents a cost, including equipment and all charges, of about 377,200*l.* per mile. The dividend now paid is $2\frac{1}{2}$ per cent.

Mr. C. Grey Mott and the City and South London Railway.

Cost of "tube" railways disappointing.

The cost of "tube" railways, as compared with "shallow" subways is comparatively little affected by the traffic and importance of the streets traversed. The land for stations, of course, imposes a heavy charge per mile on lines along leading thoroughfares or in the City, but this is a relatively small proportion of the whole cost of iron tunnels, equipment, etc., matters which are independent of the site. No doubt the cost of 600,000*l.* or 700,000*l.* per

mile for "tube" railways has been a great disappointment to all who hoped to find in them a solution of the problem of London traffic.

History repeating itself.

Tracing the history of successive extensions of the original short length of "tube" railway, it will be found that the difficulties of the Metropolitan Railway have been repeated. The cost per mile, from various unavoidable causes, has gradually increased, and the indifference of the public, as regards the raising of the capital, has been constant. Indeed, the appeal to the general public for subscriptions to the pioneer "tube" railway in 1885 met with as little response as did that for the pioneer "shallow" railway in 1855, only about 35,000*l.* having been subscribed; and, if there had been no financiers and contractors willing to accept considerable financial risks, there would probably have been no "tube" railways in London.

From constructional point of view "tubes" a success.

From a constructional point of view, the first "tube" railway was most satisfactory. Instead of constant conflicts with local authorities and frontagers on account of stoppage or obstruction of roads and footpaths, and interference with householders from underpinning and repairing damaged buildings, the public was not aware that a railway was being constructed under the streets. Again, where water and sand have been encountered, and on the old "shallow" subway system, pumping on a large scale would have been involved, and serious claims for damage to property might have arisen, the use of the shield on the "tube" system, with compressed air, has relieved engineers and contractors of much anxiety, and the costs of legal proceedings have been saved.

Working satisfactory.

As regards working, the results also were on the whole satisfactory, since, contrary to many prophesies, the public did not refuse to descend by lifts many feet below ground-level, and trust themselves in a little iron tube so closely fitted by the carriages that there was no escape by side doors, as on ordinary railways, in case of accidental stoppage of the cars in the tunnels.

Public refuse to find money for "tube" railways.

As a result of this success, many "tube" railways were projected and Acts of Parliament obtained. Engineers had gained all experience required as regards construction and working, and were ready to proceed with about 15,000,000*l.* worth of work authorised by Act of Parliament, but the public would no more find money for "tube" railways than for railways of the Metropolitan type. An attempt was made in 1897 to construct a line from Brompton to Piccadilly on a cheap basis, and an Act was obtained with capital and borrowing powers amounting to 400,000*l.* per mile. The Act, however, was useless on this basis, and additional capital powers were applied for and granted. Nothing was in fact done for some years—until an eminent firm of American financiers intervened—except in the case of small extensions of the original City and South London Railway, the short length of "tube" railway between Waterloo and the City guaranteed by the London and South Western Railway, and the important Central London Railway, which again was taken up, not by the public, but by a very powerful group of financiers. These latter gentlemen thought that the route along Oxford Street was the most valuable in London, but were probably even more influenced by the invaluable support afforded to the Company by the Corporation of London in granting a site for the Bank Station combined with public subways in the very centre of the City without payment, differing greatly in this respect from the Metropolitan Board of Works who charged the Metropolitan District Railway Company £200,000 for the easement under Victoria Embankment and Queen Victoria Street.

Inflation of capital of "tube" railways.

It has been frequently suggested that the high cost of "tube" and other underground railways is due to inflation of capital for the purpose of enabling financiers to make unreasonable profits. The question has often been raised and investigated in Parliamentary Committee Rooms, but, as Parliament has granted the capital powers asked for, and as financiers who have found money for one "tube" railway do not show any great desire to repeat the operation, it may be reasonably assumed that no reduction in the capital of "tube" railways, promoted and constructed as at present, can be looked for in the future.

Inflation of capital of "shallow" railways.

As regards "shallow" railway lines, it has also been suggested that inflation of capital explains the bad financial results; but obviously, if a

railway company, whose shares are quoted, say, at 60, in the market, wants to raise further ordinary share capital, it cannot do so at par, and the difference between par and 60 cannot legitimately be called inflation of capital. Both "shallow" and "tube" railways have no doubt in the past had to raise money on ordinary shares in this way at a discount, as well as on debentures at high rates of interest; but it has sometimes been found to the advantage of both shareholders and the public to raise money on onerous terms for the extension of a railway to a centre of busy traffic, rather than to stop it short of that centre for want of funds.

No hope of reducing capital.

On whatever side the question is approached, there appears to be no hope of reducing the capital of either "tube" or "shallow" railway lines of the present type to a sufficient extent to enable more than perhaps two or three exceptionally favourable lines to be carried out profitably by private enterprise. As in the past, the "shallow" system has been in effect a growth of the original Metropolitan Railway, so, in the future, an extension of the "tube" railway system will probably be mainly a further development and extension of existing "tube" lines. Not only would the cash cost be less for an extension than for an independent railway, by reason of the costly expenditure on generating station, repairing shops, and equipment having been already incurred, but the money could be raised more favourably, wholly or partially, as a preference charge of some kind on the older undertaking.

Expansions of existing systems.

No recommendations until lines being constructed are tested.

It is impossible to say in what direction it would be found most advantageous to extend the present "tube" railways, because experience must first be gained as to how far the extensive system now under construction meets the requirements of the public. Should the electrification of the old "shallow" underground and suburban railways, and the opening of the new "tube" railways, of which 22 miles are under construction, revolutionise the present state of affairs, as some suggest is possible, then it may be reasonable to take a more hopeful view of the future development of railway accommodation in the Metropolis by private enterprise. In any event, we do not think that they will modify the present experience, that underground railways do not relieve street congestion, or save ratepayers the cost of new streets and street widenings.

Street widenings necessary.

Evil of frequent stations.

The present type of both "shallow" and "tube" railways has been designed for, what may be called, omnibus traffic, and not for fast through traffic. Frequent stations involve not only greatly increased cost of construction, especially in "tube" railways, where lifts are required, but also of working; for the tractive force is chiefly employed in getting up the speed of the train, and, with frequent stops, the momentum has to be destroyed by the brakes as soon as the speed has been attained. With fewer stops, the power required would be diminished enormously, and the cost of construction and of the working of the electric generating plant would be therefore correspondingly reduced.

Advantage of "shallow" stations.

Again, with fewer stations it would be possible, in many cases, to combine the advantages of the "shallow" and "tube" systems. That is to say, with the goodwill of the local authorities, sites might be found where "shallow" stations might be constructed under the roadway without much interference with pipes, and where staircase access might be obtained from the footways, as is the case on the Metropolitan Railway of Paris, so that the cost of property, and also of lifts might be saved. Between those stations, the line might be constructed in "tubes," which would dip down at a sharp gradient from the "shallow" stations and so quickly get below the level of the pipes and sewers which constitute so great an obstruction to the construction of "shallow" railways with frequent stations.

Easement under private property.

In many cases it is impossible to follow the windings of a street and "tube" railways have to be carried under property. This involves costly arbitrations in the case of each house affected, as extravagant claims are generally made, and, although the amount awarded in compensation may be just, legal expenses are great. It would facilitate the construction of "tube" railways if this waste of money could be prevented, and it may be mentioned in connection with this point that the Metropolitan Board of Works and their successors, the London County Council, have long exercised their

powers of driving tunnels for main-drainage purposes under any property, paying only for any structural damage which may result. As no appreciable noise or vibration now results from the working of multiple-unit trains, it would appear to be a matter of indifference to a householder whether the tunnel when made was devoted to sewerage or to London traffic, both of which are public matters of essential necessity.

Cheap class of "tube" railway.

Lines of this class might be comparatively cheaply constructed, beginning at the fringe of the Metropolis on the north, and running through the heart of the City, dipping under the Thames and continuing to the fringe of the Metropolis on the south. There are no such through railways from north to south as the Metropolitan and Metropolitan District lines from east to west. With one station on each outskirt of the City and a very limited number of intermediate ones between those and the terminal stations it would be possible to provide the artizan dwellers in the suburbs, the passengers on suburban tramways, and the population generally with a fast and cheap service of trains. If Parliament and the public bodies co-operated in assisting such undertakings by giving all facilities for their construction, and granting land in public places suitable for the purpose for access to stations as is done in Paris, it is reasonably probable that such express lines with few stations might be made on a strictly cash basis from north to south or in other directions, at a cost, including equipment, of from 250,000*l.* to 300,000*l.* per mile.

No general rule for design and equipment.

It is hardly necessary to say that no general rule can be laid down as to the design and equipment of railways for the accommodation of suburban traffic, because the residential districts round London vary so widely in themselves. On the London and South Western Railway, for example, some of the most crowded trains in the morning and evening consist mainly of first-class carriages with passengers paying 2*s.* for the return fare to places not more distant from Waterloo than are Edmonton or Walthamstow from Liverpool Street, where the return fare is 2*d.* The latter trains, therefore, must be capable of carrying a relatively enormous number of passengers, necessarily with occasional overcrowding.

Problem of accommodating traffic at "rush-hours."

The problem of accommodating the remarkably heavy traffic at the "East-End" of London during certain hours of the day, at exceptionally low fares, has been considered independently by experienced railway managers and other experts for many years, but has not yet been successfully solved. Since the opening of the Metropolitan Railway, the Great Eastern Railway Company has spent 8,135,000*l.* in the Metropolis on new lines and widenings for suburban traffic. The magnitude and costliness of these works may perhaps be best realised by recalling the fact, stated in evidence by the General Manager of the Metropolitan Railway, that the total capital expended, on the whole 12 miles of the urban section of that railway, from Aldgate to South Kensington, and from Baker Street to Swiss Cottage, was 10,174,000*l.*, or only 2,000,000*l* more than the expenditure by the Great Eastern Company. Apart from expenditure on works, the Great Eastern Railway Company has incurred a great outlay on powerful new engines and rolling stock of exceptional carrying capacity. Complaints of overcrowding, however, still arise, and probably will continue, as the passengers apparently all want, if possible, to travel about the same time, and will crowd into the last "working-class" train.

Great Eastern Railway Company expenditure.

London, Walthamstow and Epping Forest Railway Act, 1894.

Many applications to Parliament for power to construct lines at the "East-End" have been made, and occasionally an Act has been granted. Thus the London, Walthamstow and Epping Forest Railway Act was obtained in 1894, for a total length of 15 miles from Moorgate Street, through the densely crowed "East-End" to the country surburbs. Both the Great Eastern Railway Company and the Midland Railway Company supported the line, and undertook to contribute traffic, which it was estimated would be the equivalent of 60,000*l.* per annum to the new company; but no money could be raised for the construction of this railway, although the amount of capital, as set forth in the prospectus, was the comparatively low sum of 233,000*l.* per mile. Failing to raise the money for the whole scheme, an attempt was made to obtain it for the first five miles out of London, but, as the cost of this portion averaged 570,000*l.* per mile, that attempt also failed, and the line was abandoned.

Difficulty of raising capital for "tube" railways.

No doubt the numerous plans for underground railways deposited during past years, as illustrated[1] by Sir Henry Oakley's evidence[2] before the Royal Commission, have led Parliamentary Committees and public authorities to assume that a number of capitalists were competing to be allowed to put their money into such undertakings, and so, instead of assisting struggling enterprises, heavy loads have been piled on their backs. As a matter of fact, of course, the capital has not been secured in any instance prior to the Act being obtained, and the numerous deposited plans only indicated the fact that the small initial cost of the Parliamentary part of the work had been found by parties interested, which is a very different thing to getting the capital guaranteed. The Walthamstow line is a typical illustration of the difficulties which arise after the Act has been obtained, and indicate the necessity for reducing very considerably the cost of such railways by varying the design and number of stations, by obtaining the assistance of the local authorities, and by securing the financial support of the main-line railway companies to a much greater extent than has been accorded in the past.

Cost of widening main-lines should induce companies to help independent lines.

The great cost, in most instances, of widening the main-line railways into London offers a powerful inducement for the companies to assist independent suburban lines, if the latter, by accommodating the constantly increasing suburban traffic, will render widenings at the costly end of the main-line railways, and at the terminal stations in London, unnecessary.

Cost of widenings.

For the purposes of this report the railway companies have kindly furnished figures of the actual cost of widenings for certain double lines of railway in London, from which it appears that, on the Surrey side, where the property, considered superficially, might appear to be generally of small value, the cost per mile, for works and property, has been 419,000*l.*, in one instance, and 549,500*l.*, in another; whilst, in an exceptional case at the "East-End," where a large artizan population had to be displaced and reinstated, the cost per mile of widening was 650,000*l.* These figures are so large as to lead to the hope that, by the joint action of some of the main-line companies, and of some existing or future "tube" line companies, a practical and mutually advantageous project may be devised for an extension of the "tube" or "shallow" system of railways to the suburbs. But the problem requires far more detailed consideration than can be given to it by us as an Advisory Board, and the initiation, both as regards type and general direction of the railways, must be left to the companies, who will have to find the money, if they are to be carried out.

Origin of suburban traffic.

As part of our investigations, an attempt has been made to ascertain approximately where the suburban traffic arises, and where the passengers want to go after their arrival at the terminal stations in the Metropolis, because this obviously has an important bearing upon the question of the type and direction of future railways. The railway companies have furnished much valuable information, and further information has been obtained by our Staff.

Day Census.

We would again call attention to the necessity of a day census for "Greater London"; for, had such existed in connection with the night census, the tracing of the movement of the population to their work would be comparatively easy, and, with such information, the traffic problem would more easily be mastered.

Tables and diagrams of railway passenger traffic.

The passengers arriving at and departing from these terminal stations amount to over 500,000 daily. The general distribution amongst the various stations is set forth in Tables Nos. 66 to 71 in the Appendix and Diagrams Nos. 88 to 99 already referred to, and show the extent of the traffic both in total extent and during every hour of a typical day. Passengers whose destination is the City are deposited at some terminal station, or are transferred to the lines of the Metropolitan or the Metropolitan District Railways, and are then set down within a distance of from half-a-mile to one mile, on the average, from the particular points that they desire to reach. Except by changing to an omnibus or cab, there are no efficient means of distribution of passengers provided within the City limits, as tramways do not exist.

---

[1] See Plates LXXVII. and LXXVII.a, Vol. VI.
[2] Sir Henry Oakley, Qq. 18572—18831, Vol. II.

Exchange of passengers.

As things are, the distribution of suburban passengers from the main-line terminal stations to other parts of London must usually be by interchange, and not by through running of trains. Physical junctions, in some instances, have been made, but are not used, for passengers; such as, between the Great Eastern and the Metropolitan Railways at Liverpool Street, the St. John's Wood Branch and the Metropolitan Railway at Baker Street, and the London and South Western Railway and South Eastern Railway at Waterloo. Experience would appear to indicate that, however convenient it would be that passengers should be carried through without change of carriage to every part of London, this is impossible without the use of junctions, which seem to be undesirable on busy lines, and change of carriages is the course adopted. Thus, of the total number of passengers arriving up to 10.30 a.m. at the St. John's Wood terminus at Baker Street, about 60 per cent. walk by underground passages and stairs to the Metropolitan Railway "Inner Circle" platforms to proceed further by rail to their destination, and about 40 per cent. go direct into the street. Five-sixths of those proceeding further by rail are bound Citywards. In connection with the destination of workmen and others travelling by the Whitechapel and Bow Railway morning trains, some observations were made, and it would appear that, although in that case, no change of carriage was necessary, only some 25 per cent. of the passengers proceeded further westwards than the Mansion House Station. Again, on the City and South London Railway, running from Clapham Common to Islington, the through traffic between the two last stations at Clapham to the last two at Islington is only 5 per cent. of the whole, and, in this, as in most other cases, the destination of the immense bulk of the passengers is the City.

Through running.

These facts do not detract from the truth of the proposition that running through London is preferable for suburban traffic to having termini for suburban trains in London.

It may be said with truth that during the second-half of the journey of a through suburban train in the morning, and, to a less extent, *vice versa* in the evening, there would be but few passengers: the same however is true of the return journey from a terminus. Trains must, in any case, make the outward or inward journey at times when the flow of traffic is in the opposite direction, as there is no room to store them at or near terminal stations in the heart of London. Besides, through running increases the capacity of a line as it does away with cross-shunting of trains outside a busy terminus, and, therefore, increases the capital value of the line. Another great advantage of through running is that passengers can be taken up or set down where it suits them best instead of being all collected at or distributed from one congested terminus. Well-known examples of through running which have been previously referred to are to be seen on the Metropolitan and Metropolitan District through trains from east to west, and in the service given over the London, Chatham and Dover line at Ludgate Hill.

Central London Railway.

The Central London Railway, owing to its route, is an exceptional line in many respects, as it enjoys a good mid-day traffic, and is not wholly dependent upon the City. Still in that case the City end, as regards traffic, is more than twice as productive as any intermediate point (*see* Diagrams Nos. 97 and 98, facing pages 99 and 100), although it might have been thought that a traffic, such as that at the intersection of the great shopping districts of Oxford Street and Regent Street, with all their "day shifting" population, must be at least, as good as anything the City could offer. The Central London Railway has also demonstrated the fact that a tramway may be as valuable a feeder to an underground railway as a line of surface railway, for, as regards number of passengers, the Shepherd's Bush Station of the Central London Railway is a more important station than the Paddington Station of the Great Western Railway, although that is the terminus for nearly 3,000 miles of line. (*See* Tables Nos. 67 and 70 in the Appendix.)

Diagrams Nos. 97 and 98.

Tramways a valuable feeder.

Tables Nos. 67 and 70

If London were rebuilt.

There can be no question that, if London could be entirely rebuilt, not only would the streets be made wider and straighter, but the whole system of railway termini would be remodelled. Indeed, in most instances,

probably the stations would be only terminal for a certain portion of the long-distance traffic, and the other trains would run through and find their termini in the suburbs, or, as elsewhere in some cases, where this could not be done, loops would be provided to run "shuttlecock" trains round from the up to the down side without obstructing the other lines. All questions of such improvement of the existing railways in London must, however, necessarily be left in the hands of the Engineers, General Managers, and Directors of those railways, who have a more intimate knowledge of the requirements of the traffic, and of the difficulties and possibilities of making any radical alteration in the existing terminals than anyone else can have.

Have dealt with questions as far as circumstances will permit.

We have now dealt with most of the questions affecting railways addressed to us by the Royal Commission, as far as circumstances will admit, and, although we have not submitted any general plans of new railways or detailed drawings of "shallow" subways for railways and for tramways, we have fully considered and satisfied ourselves of the practicability of the same from an engineering point of view.

Financial consideration.

Having regard to financial considerations, it is, in our opinion, inexpedient to lay down rules respecting the direction or type of railways, as such a course might possibly check the development of some cheaper type of railway than those now in use, and discourage the co-operation of independent promoters, the local authorities, and the main-line companies, who might with propriety desire or advocate something different in type and direction to that laid down, and who might be prepared to find the money for their own schemes, but not for those of others.

SUMMARY OF RECOMMENDATIONS.

For the convenience of the Royal Commission, we here summarise our general recommendations and those relating to Streets, Tramways, and Railways.

GENERAL :—

Control.

(a) The vesting of the control and regulation of traffic requirements in some one authority or some one board.

Acceleration of means of transport.

(b) The acceleration of the means of transport between the "Central Area" and the suburbs by every means possible, so as to lessen the overcrowding of many of the poorer districts of London.

Day census.

(c) The taking by Government of a day census of "Greater London" at the time of the ordinary decennial night census.

STREETS :—

Widths of new streets and widenings.

(a) The fixing of the widths of new streets and future widenings as follows :

Class of Street.	Each Footway.	Roadway.	Full Width.
	Feet.	Feet.	Feet.
"Main Avenues"	23	94	140
"First-class Arterial Streets"	18	64	100
"Second-class Streets"	16	48	80
"Third-class Streets"	12	36	60
"Fourth-class Streets"	8	24 or 34	40 or 50

(b) The future growth, as well as present needs, to be considered in deciding on the class of street to be constructed or to be formed by widening. Consideration of future growth.

(c) Height of buildings to be proportionate to width of street. Height of buildings.

(d) The construction of a "Main Avenue" east and west, marked "A" on Plan No. 8, and a "Main Avenue," north and south, with a bridge over the Thames west of the Temple, marked "B" on Plan No. 8, providing for four lines of surface tramways in each case. "Main Avenues."

(e) The substructure of "Main Avenues" to have four lines of electric railway with interchange stations for the local and express services and other stations for the local service only; two subways of a width of from 10 to 15 feet each for water mains, gas mains, etc.; and house cellars projecting under the footways for not more than 12 feet. Substructure of "Main Avenues."

(f) All "First," "Second," and "Third-class Streets," or widenings to have subways for pipes and so arranged as to facilitate railway or tramway subway construction. Subways for pipes.

(g) The construction of the following new streets :— New streets.

From Marylebone Road to Edgware Road, marked "D" on Plan No. 8.

From the Mall to Charing Cross, marked "E" on Plan No. 8.

From Cromwell Road to the west, marked "M" on Plan No. 8.

(h) The widening of the following streets :— Street widenings

The Euston and Marylebone Roads, marked "C" on Plan No. 8.

Constitution Hill, marked "F" on Plan No. 8.

Princes Street, Westminster, and a new road from thence to Waterloo Place by an incline road at the Duke of York's Column, marked "G" on Plan No. 8.

The Broad Sanctuary, Westminster, marked "H" on Plan No. 8.

The Bayswater Road, marked "I" on Plan No. 8.

The Kensington Road, marked "J" on Plan No. 8.

The Fulham and Brompton Roads, marked "K" on Plan No. 8.

King's Road, Chelsea, marked "L" on Plan No. 8.

King Street, Hammersmith, marked "N" on Plan No. 8.

Wandsworth Road, marked "O" on Plan No. 8.

The widening of swing bridges carrying public roads over dock entrances, and the doing away with hand power for working the same.

(i) The smaller new or widened old streets to be taken in hand at once, so as to give immediate relief. Those recommended are only examples of what is required, and not an exhaustive list. Immediate relief.

(j) The systematic widening of the main arterial roadways of external London, such as :— External London.

Widening of Brentford High Street, or the construction of an alternative route, marked "P" on Plan No. 8. Plan No. 8.

(k) Over or under Crossings for road traffic at points of intersection, such as :— Over or under crossings for road traffic.

Viaduct from Blackfriars Bridge to Farringdon Street, marked "Q" on Plan No. 8.

Viaduct over Strand at Wellington Street, marked "R" on Plan No. 8.

Sunken road from Berkeley Square under Piccadilly to the Green Park, and a new road thence to The Mall, with short cross streets to Jermyn Street and to Pall Mall, marked "S" on Plan No. 8.

Circuses.

(l) The enlargement of circuses and widening of streets, such as :—

The setting back of the Marble Arch and the widening of the roadway between the Edgware Road and Park Lane, marked "T" on Plan No. 8. Plan No. 8.

General Act required.

(m) The passing of a General Act of Parliament to enable all Local Authorities in "Greater London" to acquire readily the whole or portions of property required for street widenings and to systematise and accelerate the process of street widening.

Stop to encroachments.

(n) The scheduling and "declaring" of all streets requiring widening, and the immediate taking of action to stop encroachments, and to prohibit all building beyond the width enacted.

Centre columns and lamp-posts.

(o) The removal of centre tramway columns, lamp-posts &c., from roadways generally, and also obstacles at junctions where traffic is "held up."

Removal of Whitechapel Hay Market, &c.

(p) The removal of :—

Whitechapel Hay Market to Mile End Waste.
Standing vans of certain trades from the streets to private property.

Cab-ranks from the centre of main thoroughfares.
Costermongers' stalls and barrows from main thoroughfares.

Better regulation of omnibuses, &c

(q) The better regulation of :—

Omnibuses leaving stopping places.
Unloading of materials for new buildings.

Indicator on mechanically-propelled vehicles.

(r) The placing at the rear of each mechanically-propelled vehicle such as a motor omnibus or tramcar, of an indicator showing when the brakes are being applied, for the safety of vehicles following.

Laws relating to speed

(s) Reconsideration of the laws relating to the speed of vehicles with a view to possible acceleration, especially with respect to the speed of traction engines.

Footways.

(t) The levelling and paving of unrailed forecourts; the setting back of the frontages of places of amusement; and a more strict observance of the "rule of the footway" by pedestrians.

Roadways

(u) The lessening of the camber on roadways; the stopping of the practice of watering the sides of cambered roadways; the better cleansing and sanding of road surfaces; and a greater uniformity of material used in the construction of road surfaces.

TRAMWAYS :—

Extensions and the abolition of dead-ends.

(a) The increase of mileage by the extension of tramways to "points of destination," and the abolition of dead-end termini by the extension of lines south of the Thames across the river, and further extension of the southern lines to join the northern, and the eastern to join the western.

To pass railway stations.

Extensions should pass all the great railway termini and the stations of the underground railways.

Junctions

Junctions should in many cases be avoided between distinct routes which cross each other, and through running carried on between north and south and east and west.

Various routes.

(b) Various routes suggested as desirable :—

Routes Nos. 1 to 25, marked in red on Plan No. 9. Plan No. 9, p. 89.

Running powers.

(c) Universal running powers and the elimination of variation of ownership in working.

(d) Municipal construction and leasing to one central company, so as to get centralisation of administration. — Construction and leasing.

(e) The careful consideration of the probable future of the motor omnibus and its bearing on railway and tramway policy. — Motor omnibuses

---

Railways :—

(a) Two lines for a local and two lines for an express electric railway, with interchange stations for the local and express services, and stations for the local service under the "Main Avenues." — Under "Main Avenues."

(b) Separation of trains for long-distance, suburban and urban services. — Separation of trains.

(c) Suburban railway services to be run through London to termini in "Greater London," and in the case of urban railways to termini in the nearer suburbs. — Termini.

(d) Through running rather than circular, and more through routes connecting north and south and east and west for suburban traffic. — Through running.

(e) Fewer stations on railways serving the suburbs so as to get accelerated speeds, and the combining of "shallow" stations with "tube" construction where practicable. — Stations.

(f) Easement for "tube" railways as for sewers under private property, and the granting of facilities for stations by the public authorities under public places and roadways. — Easement for "tube" railways.

(g) Cheap class of "tube" railways with few stations. — Cheap class of "tube" railways.

(h) The assistance of independent lines for suburban traffic by the railway companies and municipal authorities. — Assistance.

(i) Further "tube" railways not to be sanctioned until the lines being constructed are fully tested. — Further construction.

(j) The careful consideration of the probable future of the motor omnibus and its bearing on railway and tramway policy. — Motor omnibuses.

We append at page 123 of this report an Index to our recommendations and to the portions of the report in which the various subjects above set out are more specifically discussed, including a reference to the relevant pages of the report.

CONCLUSION.

Acknowledgment of help received from the London County Council, etc.

We wish to avail ourselves of this opportunity to acknowledge our obligations to the officials of the London County Council : Mr. G. L. Gomme, Clerk ; Mr. Maurice Fitzmaurice, C.M.G., Chief Engineer ; Mr. Edgar Harper, Statistical Officer ; Mr. W. E. Riley, Architect ; Mr. Andrew Young, Valuer ; Mr. Thomas Seager Berry, the Parliamentary Officer ; Mr. A. L. C. Fell, Tramways Manager, and Mr. W. B. Roche, of the Local Government and Statistical Department ; all of whom have devoted much time to and great care in the preparation of information for which we have asked, and have willingly given the Board the value of their experience. In this connection, we should like specially to allude to the returns which have been made by the Statistical Officer, Mr. Harper, and to congratulate the County Council on the organisation and efficiency of his department. We also desire to express our sincere thanks to the following gentlemen for the courtesy and goodwill with which they met our inquiries, and placed at our service the large amount of information which they possessed on the questions at issue :—

The Rt. Hon. Sir Joseph C. Dimsdale, Bart., M.P., City Chamberlain ; Sir Homewood Crawford, City Solicitor ; Mr. James Bell, Town Clerk ; Mr. H. Montague Bates, Principal Clerk to the Public Health Department ; and Mr. D. J. Ross, City Engineer, Corporation of London. Sir Richard Nicholson, Clerk to the Middlesex County Council. Mr. T. W. Weeding, Clerk of the Surrey County Council. Mr. C. E. Longmore, Clerk, and Mr. Urban A. Smith, Surveyor to the Hertfordshire County Council. Mr. Charles J. More, Engineer to the Thames Conservancy. Mr. Harley H. Dalrymple-Hay, of the Underground Electric Railways Company of London. Mr. Granville C. Cuningham, General Manager of the Central London Railway. Mr. Thomas C. Jenkin, General Manager of the City and South London Railway. Mr. W. H. Parsons, Secretary and Manager of the East London Railway Joint Committee. Mr. Sam Fay, General Manager of the Great Central Railway. Mr. J. F. S. Gooday, General Manager of the Great Eastern Railway. Mr. Oliver Bury, General Manager of the Great Northern Railway. Mr. H. Barrow Doo, Secretary of the Great Northern and City Railway. Mr. James C. Inglis, General Manager of the Great Western Railway. Mr. William Forbes, General Manager of the London, Brighton and South Coast Railway. Sir Frederick Harrison, General Manager, and Mr. C. E. Grasemann, Goods Manager of the London and North Western Railway. Sir Charles J. Owens, General Manager, and Mr. J. H. Vickery, Assistant General Manager of the London and South Western Railway. Mr. Arthur L. Stride, Managing Director, and Mr. H. Cecil Newton, Secretary to the London, Tilbury and Southend Railway. Mr. A. C. Ellis, General Manager, of the Metropolitan Railway. Mr. W. E. Soar, Traffic Manager of the Metropolitan District Railway. Mr. John Mathieson, General Manager of the Midland Railway. Mr. F. J. Dunn, General Manager of the North London Railway. Mr. Vincent W. Hill, General Manager of the South Eastern and Chatham Railway. Mr. Thomas G. Baynes, Clerk to the Bexley Urban District Council. Mr. E. Garcke, Chairman of the British Electric Traction Company, and Mr. Ernest Hopwood, of that Company. Mr. W. C. Ullmann, Engineer to and Manager of the East Ham Urban District Council Tramways. Mr. John W. Benton, Clerk to the Ilford Urban District Council. Mr. J. Barber Glenn, Secretary to the London Southern Tramways. Mr. J. Clifton Robinson, Managing Director of the London United Tramways. Mr. James Devonshire, Managing Director of the Metropolitan Electric Tramways. Mr. R. L. Adamson, Director, and Mr. W. P. Farquharson,

Secretary to the North Metropolitan Tramways. Mr. H. E. Blain, Manager of the West Ham Corporation Tramways. Mr. A. W. Good, Secretary to the Woolwich and South East London Tramways. Mr. J. L. Pound, Chairman of, and Mr. Laurence G. Oldfield, Secretary to the London Omnibus Owners' Federation. Mr. Charles Norman, Secretary to the London Parcels Delivery Company; and Messrs. Pickfords, Limited.

We also beg to express our thanks to the Chief Engineers of Paris, Berlin, Vienna, Brussels, and Hamburg, for the information they so readily afforded us.

Mr. Lynden Macassey, M.A., B.Sc., LL.D.

We are desirous of expressing our appreciation of the nature and extent of the valuable services voluntarily rendered to us by Mr. Lynden Macassey, M.A., B.Sc., LL.D., in material addition to his duties as Secretary to the Royal Commission, and of the extensive information which he from time to time placed at our disposal relative to traffic conditions in London and abroad.

Mr. A. F. Macrae, M.A.

We further desire to express the obligations we are under to Mr. Angus Fraser Macrae, M.A., who has acted as Secretary to the Advisory Board.

Mr. R. C. H. Davison, M.Inst.C.E.

To Mr. R. C. H. Davison, M.Inst.C.E., who has acted as our Chief Engineer and directed the work of our Engineering Staff, we desire to express our cordial acknowledgments, and to place on record our testimony to the extent by which our investigations have profited by his efforts, and by the valuable statistics which he has compiled.

Engineering Staff.

Our thanks are also due to Mr. Walter Beer, Assoc.M.Inst.C.E., who was entrusted with important investigations; to Mr. J. F. J. Reynolds, Assoc.M.Inst.C.E., and Mr. R. B. Dunwoody, Assoc.M.Inst.C.E., who have conducted much of the office work; and to the rest of our Engineering Staff.

We have the honour to be,

Sir,

Your obedient Servants,

J. WOLFE-BARRY.

BENJAMIN BAKER.

WM. BARCLAY PARSONS.

SUMMARISED INDEX TO THE RECOMMENDATIONS OF THE ADVISORY BOARD OF ENGINEERS

AND TO THE PORTIONS OF THEIR REPORT RELEVANT THERETO.

The Recommendations are printed in *italics* and appear in summarised form on pages 116 to 119 of the Report (ante).

SUBJECT.	PAGE OF REPORT.
GENERAL :—	
(a) *The vesting of the control and regulation of traffic requirements in some one authority or some one board.* - - - -	116
System in other cities. - - - - - - - -	3
Results of defined ideas. - - - - - - - -	4
Control should be vested in one authority or one board. - -	9
Importance of immediate action. - - - - -	47
(b) *The acceleration of the means of transport between the "Central Area" and the suburbs by every means possible, so as to lessen the over-crowding of many of the poorer districts of London.* -	116
Loss caused by want of travelling facilities. - - - -	4
Memorandum by Sir John Wolfe-Barry and Mr. R. C. H. Davison. -	5
Speeds of vehicles. - - - - - - - -	24
Typical journeys from the suburbs to the "Central Area." - -	26
Time taken to reach "Central Area" from suburbs - - -	27
(c) *The taking by Government of a day census of "Greater London" at the time of the ordinary decennial night census* - - -	116
Day Census required. - - - - - - - -	10, 114
STREETS :—	
(a) *The fixing of the widths of new streets and future widenings as follows :—* - - - - - - - - - -	116

Class of Street.	*Each Footway.*	*Roadway.*	*Full Width.*
	feet.	*feet.*	*feet.*
"Main Avenues" - - - -	23	94	140
"First-class Arterial Streets" - -	18	64	100
"Second-class Streets" - - -	16	48	80
"Third-class Streets" - - -	12	36	60
"Fourth-class Streets" - - -	8	24 *or* 34	40 *or* 50

What new streets would provide. - - - - -	29
Widths of new streets and widenings. - - - - -	32
Widths of London streets. - - - - - -	30, 84
Old Kent Road, Whitechapel Road, &c. - - - -	46

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
Widths of certain streets in foreign cities.	31
Avenues and "First" and "Second-class Streets" necessary in order to get an adequate service of tramways	35
Widening of streets necessary.	87
Street widenings necessary.	112
(b) *The future growth, as well as present needs, to be considered in deciding on the class of street to be constructed or to be formed by widening.*	117
Streets planned to meet local needs alone.	2
Street improvements for future growth as well as for present needs.	67
(c) *Height of buildings to be proportionate to width of street.*	117
Height of buildings should be proportionate to width of street.	32
Height of buildings.	33
(d) *The construction of a "Main Avenue" east and west, marked "A" on Plan No. 8, and a "Main Avenue" north and south, with a bridge over the Thames west of the Temple, marked "B" on Plan No. 8, providing for four lines of surface tramways in each case.*	117
Salient requirements.	35
Two "Main Avenues."	35
East and west "Main Avenue."	35
North and south "Main Avenue."	38
Table of widths of new streets and widenings.	33
Road traffic which "Main Avenues" should provide for.	32
Alternative routes.	58
Tramways on new streets.	32
Sketch showing suggested "Main Avenues" (Plate No. 1) facing page	32
Sketch showing suggested "Main Avenues" at express station (Plate No. 3) facing page	34
Sketch showing suggested "Main Avenues" at local stations (Plate No. 4) facing page	35
(e) *The substructure of "Main Avenues" to have four lines of electric railway with interchange stations for the local and express services and other stations for the local service only; two subways of a width of from 10 to 15 feet each for water mains, gas mains, etc.; and house cellars projecting under the footways for not more than 12 feet.*	117
What new streets would provide.	29

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
What the substructure of new streets should provide for.	29
Utilisation of substructures of new streets.	33
Extent to which cellars should project	34
Pipe subways	34
Substructure of "Main Avenues" and streets.	34
Value of railways under "Main Avenues."	37
Additional railways dependent on new streets.	102
Sketch showing suggested "Main Avenues" (Plate No. 1) facing page	32
Sketch showing suggested "Main Avenues" at express station (Plate No. 3) facing page	34
Sketch showing suggested "Main Avenues" at local station (Plate No. 4) facing page	35
Sketch showing four-track subway in New York (Plate No. 5) facing page	36
(f) *All "First," "Second," and "Third-class Streets" or widenings to have subways for pipes and so arranged as to facilitate railway or tramway subway construction.*	117
What new streets would provide.	29
What the substructure of new streets should provide for.	29
Utilisation of substructure of new streets.	33
Substructure of "Main Avenues" and streets.	34
Electrical railway or tramway subway.	34
Additional railways dependent on new streets.	102
Sketch showing suggested "First-Class Arterial Street" (Plate No. 2) facing page	33
(g) *The construction of the following new streets:—*	117
From Marylebone Road to Edgware Road, marked "D" on Plan No. 8.	117
Plan No 8 in report, facing page	68
New street from Marylebone Road to Edgware Road, facing Harrow Road.	40
From the Mall to Charing Cross marked "E" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
New road from The Mall to Charing Cross	40
Extension of Mall.	58
From Cromwell Road to the west, marked "M" on Plan No. 8.	117

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
Plan No. 8 in report, facing page	68
Extension of Cromwell Road.	45
(h) *The widening of the following streets :—*	117
The Euston and Marylebone Roads, marked "C" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
Widening of the Euston and Marylebone Roads.	39
Act of George II.	39
Width between boundaries of private property, Table	39
Length bordered by :—Gardens or enclosed forecourts, Table	40
Length bordered by :—Buildings one-story high, Table	40
Length bordered by :—Buildings more than one-story, Table	40
The net area of the land required for widening the Euston and Marylebone Roads to 100 feet from King's Cross to Stafford Street, and the nature of the property required, illustrated by Diagram No. 4, facing page	40
For plan of the Euston and Marylebone Roads, *see* Plan No. 19, facing page	84
Constitution Hill, marked "F" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
Widening of Constitution Hill.	41
Princes Street, Westminster, and a new road thence to Waterloo Place by an incline road at the Duke of York's Column, marked "G" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
Widening of Princes Street, Westminster, and new road thence to Waterloo Place.	41
The Broad Sanctuary, Westminster, marked "H" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
Widening of Broad Sanctuary, Westminster.	41
The Bayswater Road, marked "I" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
Widening of Bayswater Road, Kensington Road, Fulham and Brompton Roads, and King's Road, Chelsea.	41
Present traffic on these four roads.	41
Widths between boundaries of private property, Table	43

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
Percentage of length bordered by :—Gardens or enclosed forecourts, Table, page	43
Percentage of length bordered by :—Buildings one-story high, Table, page	43
Percentage of length bordered by :—Buildings more than one-story high, Table	43
The net area of the land required for widening the Bayswater Road to 100 feet from the Uxbridge Road Station to Edgware Road, and the nature of the property required, illustrated by Diagram No. 4A, facing page	42
For plan of Bayswater Road, see Plan No. 15, facing page	82
Shepherd's Bush to Whitechapel Route.	54
The Kensington Road, marked "J" on Plan No. 8.	117
Plan No. 8 in report facing page	68
Widening of Bayswater Road, Kensington Road, Fulham and Brompton Roads, and King's Road, Chelsea.	41
Present traffic on these four roads.	41
Width between boundaries of private property, Table	43
Percentage of length bordered by :—Gardens or enclosed forecourts, Table	43
Percentage of length bordered by :—Buildings one-story high, Table	43
Percentage of length bordered by :—Buildings more than one-story high, Table	43
The net area of the land required for widening the Hammersmith Road to 100 feet from Hammersmith Broadway to Knightsbridge, and the nature of the property required, illustrated by Diagram No. 4B, facing page	44
For plan of Kensington Road, *see* Plan No. 10, facing page	80
Hammersmith Broadway to Mansion House Station Route.	55
The Fulham and Brompton Roads, marked "K" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
Widening of Bayswater Road, Kensington Road, Fulham and Brompton Roads, and King's Road, Chelsea.	41
Present traffic on these four roads.	41
Width between boundaries of private property, Table, page	44
Percentage of length bordered by :—Gardens or enclosed forecourts, Table	44
Percentage of length bordered by :—Buildings one story high, Table	44
Percentage of length bordered by :—Buildings more than one story high, Table	44

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
The net area of the land required for widening the Fulham Road to 100 feet from Fulham Palace Road to Knightsbridge, and the nature of the property required, illustrated by Diagram No. 4c, facing page	46
For plan of Fulham and Brompton Roads *see* Plan No. 11, facing page-	80
Fulham Road, Table No. 52 in the Appendix.	
King's Road, Chelsea, marked "L" on Plan No. 8. - -	117
Plan No. 8 in report, facing page - - - - -	68
Widening of Bayswater Road, Kensington Road, Fulham and Brompton Roads, and King's Road, Chelsea. - - - - -	41
Present traffic on these four roads. - - - - -	41
Mal-arrangement of King's Road, Chealsea. - - - -	45
Width between boundaries of private property, Table - -	44
Percentage of length bordered by:—Gardens or enclosed forecourts, Table - - - - - - - - -	44
Percentage of length bordered by:—Buildings one-story high, Table - - - - - - - -	44
Percentage of length bordered by:—Buildings more than one-story high, Table - - - - - - - - -	44
The net area of the land required for widening the King's Road, Chelsea, to 100 feet from Fulham High Street to Sloane Square, and the nature of the property required, illustrated by Diagram No. 4d, facing page - - - - - - - - - -	48
For plan of King's Road, Chelsea, *see* Plan No. 18, facing page -	82
King's Road, Chelsea, Table No. 53 in the Appendix.	
King's Street, Hammersmith, marked "N" on Plan No. 8. -	117
Plan No. 8 in report, facing page - - - - -	68
Hammersmith Broadway and King Street, Hammersmith. - -	46
Speed of tramway cars. - - - - - - - -	25
Wandsworth Road, marked "O" on Plan No. 8. - -	117
Plan No. 8 in report, facing page - - - - -	68
Wandsworth Road. - - - - - - - -	46
The widening of swing bridges carrying public roads over dock entrances and the doing away with hand power for working the same. - - - - - - - -	117
Subordinate matters requiring attention. - - - -	67
See Mr. Joseph Henry Robinson's evidence (Qq. 9650, 9653, Vol. II.) given before the Royal Commission.	
(i) *The smaller new or widened old streets to be taken in hand at once, so as to give immediate relief. Those recommended are only examples of what is required, and not an exhaustive list.* -	117

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
The smaller schemes should be carried out while preparing for the larger.	39
Other suggestions for new and widened streets.	38
Roads discussed are only instances for immediate improvement.	46
(j) *The systematic widening of the main arterial roadways of external London, such as :—*	117
Widening of Brentford High Street, or the construction of an alternative route, marked "P" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
Other suggestions for new and widened streets.	38
All trunk roads require to be systematically dealt with.	46
Main arterial roadways of external London.	47
Very little care being given to road widenings in external London, example at Brentford.	47
Position at Brentford.	47
Other instances of constriction of main routes.	47
Absence of controlling authority.	47
(k) *Over or under Crossings for road traffic at points of intersection, such as :—*	117
Viaduct from Blackfriars Bridge to Farringdon Street, marked "Q" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
Salient requirements.	35
Intersection of traffic.	48
Eight representative crossings.	55
Effect of configuration of junction.	56
Goods and passenger vehicles.	57
Over or under crossings for road traffic.	62
Holborn Viaduct.	62
As important as Holborn Viaduct was.	63
East and west viaduct very difficult.	63
Viaduct from Blackfriars Bridge to Farringdon Street recommended.	63
Sir Henry Knight's proposed viaduct.	63
Injury to property and cost of larger viaduct.	63
The larger scheme recommended.	64

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
Cross traffic at Ludgate Circus and Queen Victoria Street, Tables Nos. 46 and 51 and Diagrams Nos. 59, 60, 68, and 69 in Appendix.	
Delays, Table No. 56 and Diagram No. 72 in Appendix.	
Viaduct over Strand at Wellington Street, marked "R" on Plan No. 8.	117
Plan No. 8 in report, facing page	68
Salient requirements.	35
Intersection of traffic.	48
Eight representative crossings.	55
Effect of configuration of junction.	56
Goods and passenger vehicles.	57
Over or under crossings for road traffic.	62
Traffic at Wellington Street, Strand.	64
Bridge over the Strand does not present any engineering difficulty.	64
New bridge over Thames west of the Temple.	64
Cost of bridge over the Strand at Wellington Street.	64
London County Council's Chief Engineer raised another consideration.	64
Wellington Street improvement should not be lost sight of.	64
Cross traffic in Strand at Wellington Street, Table No. 44 and Diagrams Nos. 56 and 57 in Appendix.	
Delays, Table No. 55 and Diagram No. 71 in Appendix.	
Sunken road from Berkeley Square under Piccadilly to the Green Park, and a new road thence to The Mall, with short cross streets to Jermyn Street and Pall Mall, marked "S" on Plan No. 8.	117
Plan, No. 8 in report, facing page	68
Salient requirements.	35
Intersection of traffic.	48
Eight representative crossings.	55
St. James's Street and Berkeley Street crossing.	58
Over or under crossings for road traffic.	62
Piccadilly at Berkeley Street and St. James's Street.	64
Interference with Green Park, Devonshire House, and Lansdowne House.	65
Similar new street in Rome.	65
Cross traffic in Piccadilly at St. James's Street, Table No. 40 and Diagrams Nos. 49 and 50 in the Appendix.	

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
Delays, Table No. 54 and Diagram No. 70 in the Appendix.	
(l) *The enlargement of circuses and widening of streets such as :—*	118
The setting back of the Marble Arch and the widening of the roadway between the Edgware Road and Park Lane, marked "T" on Plan No. 8.	118
Plan No. 8 in report, facing page	68
Intersection of traffic.	48
Eight representative crossings.	55
Effect of "season."	55
Effect of configuration of junction.	56
Variation of widths of roadway.	56
Goods and passenger vehicles.	57
Circuses and road widenings at junctions.	58
Improvements at junctions only local.	58
Widening at Marble Arch recommended.	65
Widening of streets at crossings.	65
Existing circuses too small.	65
Cross traffic should be marshalled and passed on as wide a front as possible.	65
(m) *The passing of a General Act of Parliament to enable all Local Authorities in "Greater London" to acquire readily the whole or portions of property required for street widenings and to systematise and accelerate the process of street widening.*	118
New Act required.	68
(n) *The scheduling and "declaring" of all streets requiring widening and the immediate taking of action to stop encroachments and to prohibit all building beyond the width enacted.*	118
Act of George II.	39
Immediate steps required to prevent building on forecourts and gardens.	45
Encroachments should be stopped.	47
Importance of immediate action.	47
General policy for London.	47
New Act required.	68

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
(o) *The removal of centre tramway columns, lamp-posts, &c., from roadways generally, and also obstacles at junctions where traffic is "held up."*	118
Evil of having lamp-posts, &c., in the roadway.	55
Obstructions by lavatories, statues, fountains, and lamp pillars.	65
Evil of lamp posts and electric cable standards being placed in the centre of roadways.	65
(p) *The removal of:—*	118
Whitechapel Hay Market to Mile End Waste.	118
Situation of markets.	67
Whitechapel Hay Market.	67
Standing vans of certain trades from the streets to private property.	118
Stationary vehicles at sides of streets.	32
Standing vehicles at kerbs loading and unloading.	66
Railway receiving houses, &c.	66
Cab-ranks from the centre of main thoroughfares.	118
Obstruction by cab-ranks.	65
Costermongers' stalls and barrows from main thoroughfares.	118
King Street, Hammersmith.	25
Obstruction by costermongers' stalls and barrows.	67
(q) *The better regulation of:—*	118
Omnibuses leaving stopping places.	118
Subordinate matters requiring attention.	67
See Mr. Stephen Sellons's evidence (Qq. 13387, 13393, Vol. II.), and Mr. Lawrence Russell's evidence (Q. 17309, Vol. II.) given before the Royal Commission.	
Unloading of materials for new buildings.	118
Subordinate matters requiring attention.	67
See Mr. Thomas Cole's evidence (Q. 8228, Vol. II.), given before the Royal Commission.	
(r) *The placing at the rear of each mechanically-propelled vehicle, such as a motor omnibus or tramcar, of an indicator showing when the brakes are being applied, for the safety of vehicles following.*	118
Indication that brakes are being applied.	26

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
STREETS—*continued.*	
(s) *Reconsideration of the laws relating to the speed of vehicles with a view to possible acceleration, especially with respect to the speed of traction engines.* - - - - - - - -	118
Speed of traction engines and motor vans. - - - -	25
Speeds of motor omnibuses. - - - - - - -	25
Speeds of tramway cars. - - - - - - - -	25
(t) *The levelling and paving of unrailed forecourts; the setting back of the frontages of places of amusement; and a more strict observance of the "rule of the footway" by pedestrians.* - - -	118
Subordinate matters requiring attention. - -	67
See Mr. James Rush Dixon's evidence (Q. 10017, Vol. II.), Mr. J. H. Brown's evidence (Q. 9064, Vol. II.), and Mr. Henry Corbett Jones's evidence (Q. 11726, Vol. II.), given before the Royal Commission.	
(u) *The lessening of the camber on roadways; the stopping of the practice of watering the sides of highly cambered roadways; the better cleansing and sanding of road surfaces; and a greater uniformity of material used in the construction of road surfaces.* - - - - - - - - -	118
Subordinate matters requiring attention. - - - -	67
Re camber and watering, *see* Sir Alexander Carmichael Bruce's evidence (Q. 7520, Vol. II.), Mr. John Lulham Pound's evidence (Q. 17604, Vol. II.), Mr. W. Rees Jeffreys' evidence (Q. 18176, Vol. II.), Mr. Samuel Michaels' evidence (Q. 17227, Vol. II.), and Mr. Lawrence Russell's evidence (Q. 17324, Vol. II.), given before the Royal Commission.	
Re cleansing and sanding, *see* Sir Alexander Carmichael Bruce's evidence (Qq. 7533, 7817, Vol. II.), Mr. Samuel Michaels' evidence (Q. 17235, Vol II.), Mr. Lawrence Russell's evidence (Q. 17324, Vol. II.), and Mr. W. Rees Jeffreys' evidence (Q. 18176, Vol. II.), given before the Royal Commmission.	
Re varied material used in the construction of road surfaces, *see* Mr. Maurice Fitzmaurice's evidence (Q. 6181, Vol. II.), and the Hon. John Scott-Montagu's evidence (Qq. 1859, 1894, Vol. II.), given before the Royal Commission.	
TRAMWAYS:—	
(a) *The increase of mileage by the extension of tramways to "points of destination," and the abolition of dead-end termini by the extension of lines south of the Thames across the river, and further extension of the southern lines to join the northern, and the eastern to join the western.*	
Extensions should pass all the great railway termini and the stations of the underground railways.	
Junctions should in many cases be avoided between distinct routes which cross each other, and through running carried on between north and south and east and west. - - - -	118
Number of inhabitants per mile of tramway. - - -	71

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
TRAMWAYS—*continued.*	
The three "tramway sections" unconnected.	75
"Greater London" unconnected.	75
Failure of tramways to reach "points of destination."	76
Defects of the London tramways.	77
Tramway termini stop short of "points of destination."	77
Inconvenience to passengers.	77
Dead-end termini.	75
Six terminal points considered.	76
No tramway car should end its journey while fully loaded.	77
Capacity of tramways or railways limited by cross-shunting of cars at dead-end termini.	77
Existing termini of tramways seriously reduce capacity of lines.	78
Remedy for the three fundamental deficiencies in London tramways.	78
Extensions would eliminate dead-ends and connect north and south.	82
No tramways cross the Thames.	75
Extensions and improvements most urgently required.	79
Tramways should pass the great railway termini.	84
Tramways should pass the stations of the underground railways.	80
Junctions should be avoided and traffic resolved into two components.	79
Through running.	84
(b) *Various routes suggested as desirable:—Routes Nos.* 1 *to* 25, *marked in red on Plan No.* 9.	118
Plan No. 9 in report, facing page	88
Hammersmith Bridge, marked Route No. 1 *in red on Plan No.* 9.	80
Hammersmith to Aldgate, marked Routes Nos. 2 *and* 3 *in red on Plan No.* 9.	80
Also *see* Plan No. 10, facing page	80
Fulham and Brompton Roads, marked Route No. 4 *in red on Plan No.* 9.	81
Also *see* Plan No. 11, facing page	80
Victoria to Marble Arch, marked Route No. 5 *in red on Plan No.* 9.	81
Edgware Road and Maida Vale, marked Route No. 6 *in red on Plan No.* 9.	81
Also *see* Plan No. 12 in the Appendix	

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
TRAMWAYS—*continued.*	
Paddington and Harrow Road, marked Route No. 7 in red on Plan No. 9.	81
Also *see* Plan No. 13 in the Appendix.	
Cambridge Avenue and Harrow Road, marked Route No. 8 in red on Plan No. 9.	81
Also *see* Plan No. 14 in the Appendix.	
Shepherd's Bush and Marble Arch, marked Route No. 9 in red on Plan No. 9.	81
Also *see* Plan No. 15, facing page	82
Westminster Bridge and Victoria Embankment to Waterloo Bridge, marked Route No. 10 in red on Plan No. 9.	81
Blackfriars Bridge and Victoria Embankment to Waterloo Bridge, marked Route No. 11 in red on Plan No. 9.	82
Blackfriars Bridge and Southwark Bridge, marked Route No. 12 in red on Plan No. 9.	82
Blackfriars Bridge and Farringdon Street on Viaduct, marked Route No. 13 in red on Plan No. 9.	82
Viaduct from Blackfriars Bridge to Farringdon Street recommended.	63
Farringdon Road to Gray's Inn Road, marked Route No. 14 in red on Plan No. 9.	82
York Road and Stamford Street, marked Route No. 15 in red on Plan No. 9.	83
Also *see* Plan No. 16 in the Appendix.	
Connection east of the Tower Bridge, marked Route No. 16 in red on Plan No. 9.	83
Tottenham Court Road, Charing Cross Road and Whitehall, marked Route No. 17 in red on Plan No. 9.	83
Moorgate, Liverpool Street and Norton Folgate, marked Route No. 18 in red on Plan No. 9.	83
Also *see* Plan No. 17 in the Appendix.	
Aldersgate to General Post Office, marked Route No. 19 in red on Plan No. 9.	83
King's Road, Sloane Square and Victoria Station, marked Route No. 20 in red on Plan No. 9.	83
Also *see* Plan No. 18, facing page	82
Victoria Street, Westminster, marked Route No. 21 in red on Plan No. 9.	84

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
TRAMWAYS—*continued.*	
Marylebone and Euston Roads, marked Route No. 22 in red on Plan No. 9.	84
Also *see* Plan No. 19, facing page	84
Upper Baker Street and Finchley Road, marked Route No. 23 in red on Plan No. 9.	84
Also *see* plan No. 20, facing page	84
Proposed East and West "Main Avenue," four lines, marked Route No. 24 in red on Plan No. 9.	79
Proposed North and South "Main Avenue," four lines, marked Route No. 25 in red on Plan No. 9.	79
Road traffic which "Main Avenues" should provide for.	32
Tramways on new streets.	32
Tramway facilities should not wait for construction of "Main Avenues."	79
Recommendations are only general, given as examples.	79
Lines suggested only primary lines.	88
(c) *Universal running powers and the elimination of variation of ownership in working.*	118
Extensions and improvements most urgently required.	79
Variation of ownership should be eliminated in the working of tramways.	84
Universal running powers for all tramways of "Greater London."	85
(d) *Municipal construction and leasing to one central company, so as to get centralisation of administration.*	119
Policy in Paris, Vienna, Berlin, Brussels, Buda-Pesth, Rome, New York, Boston.	3
Financial considerations not dealt with in detail.	5
Judicious centralisation.	9
Advantage of one working company.	85
Municipally constructed railways in other cities.	85
(e) *The careful consideration of the probable future of the motor omnibus and its bearing on railway and tramway policy.*	119
Speed of motor omnibuses and their important bearing on railway and tramway policy.	25
Motor omnibuses.	87

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
RAILWAYS :—	
(a) *Two lines for a local and two lines for an express electric railway, with interchange stations for the local and express services, and stations for the local services under the "Main Avenues."* - - - - - - - - - - -	119
What new streets would provide. - - - - -	29
What the substructure of new streets should provide for. - -	29
Substructure of "Main Avenues" and streets. - - - -	35
Railway connections. - - - - - - - -	36
Value of railways under "Main Avenues." - - - -	37
Additional Railways dependent on new streets. - - - -	102
Sketch showing suggested "Main Avenues" (Plate No. 1.) facing page	32
Sketch showing suggested "Main Avenues" at express station (Plate No. 3) facing page - - - - - - - -	34
Sketch showing suggested "Main Avenues" at local station (Plate No. 4) facing page - - - - - - - -	35
Sketch showing four-track subway, New York (Plate No. 5) facing page	36
(b) *Separation of trains for long-distance, suburban and urban services.* - - - - - - - - - - -	119
Cause of delays on railways. - - - - - - -	35
The attempt to cater for the three classes not a success. - -	91
(c) *Suburban railway services to be run through London to termini in "Greater London," and in the case of urban railways to termini in the nearer suburbs.* - - - - - - -	119
Concentration of traffic at terminal stations compared with advantage of through running. - - - - - - - -	35
Railway termini. - - - - - - - - -	77
Capacity of tramways or railways limited by cross-shunting of cars at dead-end termini. - - - - - - -	77
Object to be aimed at is through running. - - - -	102
Through running. - - - - - - - -	115
If London were rebuilt. - - - - - - - -	115
(d) *Through running rather than circular, and more through routes connecting north and south and east and west for suburban traffic.* - - - - - - - - -	119
What new streets would provide. - - - - - -	29
Concentration of traffic at terminal stations compared with advantage of through running. - - - - - - -	35

INDEX TO RECOMMENDATIONS—*continued.*

SUBJECT.	PAGE OF REPORT.
RAILWAYS—*continued.*	
Insufficient through routes to relieve terminal stations.	102
Metropolitan and Metropolitan District Railways through east and west services.	102
Through running preferable to circular running.	102
Suggested extensions to get through running.	102
(e) *Fewer stations on railways serving the suburbs so as to get accelerated speeds, and the combining of "shallow" stations with "tube" construction where practicable.*	119
Effect of frequent stations on speed.	26
Distance apart of stations.	34
Evil of frequent stations.	112
Advantage of having railway stations close to the surface of streets.	34
Advantage of "shallow" stations.	112
(f) *Easement for "tube" railways as for sewers under private property, and the granting of facilities for stations by the public authorities under public places and roadways.*	119
Easement under private property.	112
Financial considerations not dealt with in detail.	5
Can railways be extended without ratepayers' assistance?	103
Cheap class of "tube" railway.	113
(g) *Cheap class of "tube" railways with few stations.*	119
Cheap class of "tube" railway.	113
(h) *The assistance of independent lines for suburban traffic by the railway companies and municipal authorities.*	119
Cheap class of "tube" railway.	113
Cost of widening main lines should induce companies to help independent lines.	114
(i) *Further "tube" railways not to be sanctioned until the lines being constructed are fully tested.*	119
No recommendations until the lines being constructed are tested.	112
(j) *The careful consideration of the probable future of the motor omnibus and its bearing on railway and tramway policy.*	119
Speed of motor omnibuses and their important bearing on railway and tramway policy.	25
Motor omnibuses.	87

THE END.

GENERAL INDEX TO THE TEXT OF THE REPORT.

ABBREVIATIONS.

B. St. & W.R.	Baker Street and Waterloo Railway.
C.L.R.	Central London Railway.
CX. E. & H.R.	Charing Cross, Euston and Hampstead Railway.
C. & B.R.	City and Brixton Railway.
C. & S.L.R.	City and South London Railway.
G.C.R.	Great Central Railway.
G.E.R.	Great Eastern Railway.
G.N.R.	Great Northern Railway.
G.N.P. & B.R.	Great Northern, Piccadilly, and Brompton Railway.
G.N. & C.R.	Great Northern and City Railway.
G.W.R.	Great Western Railway.
L.B. & S.C.R.	London, Brighton and South Coast Railway.
L.N.W.R.	London and North Western Railway.
L.S.W.R.	London and South Western Railway.
L. T. & S.R.	London, Tilbury and Southend Railway.
M.R.	Midland Railway.
S.E. & C.R.	South Eastern and Chatham Railway.
N.L.R.	North London Railway.

PAGE

Acknowledgments:
- to L.C.C. officials - - - - - - 120
- to other County Council officials - - - 120
- to City Corporation officials - - - - 120
- to railway officials - - - - - - 120
- to tramway officials - - - - - 120-121

Acton, W., typical journey to Bank by Tramway and Central London Railway - - - - - 26

Acts of Parliament, *see under* Parliament.

Addison Road Station, accommodation, number of passengers dealt with at, and suburban services - - - - - - - - - - 94, 95

Albert Bridge, S.W., scheme for tramway over - 79

Aldersgate Street, E.C.:
- Traffic returns - - - - - - - - 18
- Underground Tramway scheme to Cheapside or Southwark Bridge - - - - - - - 33
- Width of street - - - - - - - - 30

Aldersgate Within, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

Aldersgate Without, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

Aldgate, E.
- Traffic returns - - - - - 18, 49-50, 57
- Tramways:
  - Scheme for, to Hammersmith - - - 80
  - Terminus, number of passengers per day alighting from, and joining cars at - 75

Aldgate, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - - 15

PAGE

Aldgate High Street, E., traffic returns - - - 11

America, *see* United States of America.

Austria, *see* Buda-Pesth and Vienna.

Baker Street Station (Metropolitan Railway):
- Accommodation, number of passengers dealt with per annum, and suburban services - 95
- Distribution of passengers arriving at, from St. John's Wood line - - - - - 115
- Scheme for tramway connection - - - 84

Baker Street and Waterloo Railway, *see under* Railways.

Bank, E.C.:
- Speed of omnibuses, from Clarges Street - 25
- Traffic:
  - Delays - - - - - - 59, 60-61
  - Returns - - - 49-50, 55, 57, 61, 62
- Typical journeys - - - - - - - 26

Bank Stations:
- Central London Railway, site for, granted free by Corporation of London - - - - 111
- Typical journeys from Raynes Park and Richmond - - - - - - - - - 27

Barking Town Urban District Council Light Railway, route, mileage - - - - - - - 72

BARLOW, PETER, "On the Relief of London Street Traffic," by, referred to - - - - 110

Barrows, traffic returns - - - - 11, 61, 62

Bassishaw, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - - 15

PAGE

Battersea, amount paid from rates for new streets, improvements and widenings since 1856 - - 7, 8

Bayswater Road, W..
Lengths bordered by various classes of property 43
Scheme for "Main Avenue" to Whitechapel 35-37
Traffic returns - - - -11, 41, 42, 45, 49-50
Tramways along, advisable, scheme for, and consequent improvement - - 41-43, 46, 81
Widening, scheme for - - - 41-43, 117
Widths of street - - - - - 42, 56

Beckenham Urban District Council Tramways, route and mileage - - - - 73

BEER, WALTER, Assoc. M.Inst.C.E., scheme for main avenues from north to south and from east to west - - - - - - - 35, 36-37, 39
Acknowledgment for services rendered - - 121

Belgium, *see* Brussels.

BENN, J. W., evidence *re* cost of tramways referred to - - - - - - - - - 78

Berkeley Square, W., sunken road under Piccadilly to Green Park from, recommended - - - 117

Berkeley Street, W.:
Cross traffic at St. James's Street, recommendations *re* - - - - - - - 58
Intersection of traffic at Piccadilly, scheme for relief of, by sunken road to Green Park 64-65

Broad Street, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - 15

Berlin:
Streets:
Remodelled - - - - - - - 3
Widths of - - - - - - - 31
Traffic returns - - - - - - - 24
Tramways:
Ratio of mileage to population - - - 71
Traffic returns - - - - - - 76

Bermondsey, S.E.:
Amount paid from rates towards new streets, widenings and improvements since 1856 - 7, 8
Tramway to City needed, and scheme for - 83

Bethnal Green, E., amount paid from rates for new streets, widenings and improvements since 1856 - 7, 8

Bexley Urban District Council Tramways, route and mileage - - - - - - - - - 73

Billingsgate Fish Market, congestion caused by position and heavy traffic to, and removal suggested - - - - - - - - - - 67

Billingsgate, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - 15

Bills, *see under* Parliament.

Bishop's Road Station (G.W.R.), accommodation at, number of passengers dealt with per annum, and suburban services - - - - - - - 92

Bishopsgate Goods Station (G.E.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - - 17

Bishopsgate Street, E.C., traffic returns - - - 18

Bishopsgate Within, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

Bishopsgate Without, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

Blackfriars Bridge and "Elephant and Castle," vehicular traffic and points of intersection between - - - - - - - - - - 53

Blackfriars Bridge, S.E.:
Traffic returns - - - - - - 53, 82

PAGE

Blackfriars Bridge, S.E.—*continued.*
Tramways:
Scheme for, across bridge - - - - - 79
Terminus, number of passengers per day alighting from and joining cars at - - 75
on Viaduct to Farringdon Street, scheme for - - - - - - - - - 82
to Westminster Bridge, scheme for - 82, 83
Viaduct scheme to Farringdon Street recommended - - - - - - 63, 64, 117

Blackfriars Road Goods Station (S.E. and C.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - 17

Bloomsbury Tramway terminus, number of passengers per day alighting from and joining cars at - 75

Board of Trade:
Maximum speed of electric tramways under regulations of - - - - - - - 25
Underground communications under control of 108

Borough Councils:
Expenditure on street improvements, bridges and widenings - - - - - - - 6
Full advantage of Michael Angelo Taylor's Act not taken by - - - - - - - - 68

Borough Market, congestion caused by position and heavy traffic to, and removal suggested - - 67

Boston, *see under* United States of America.

Bow, E., main road through, inadequate - - 47

Bow and Whitechapel Railway, *see* Whitechapel and Bow Railway, *under* Railways.

Bread Street, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - 15

Brentford, main road through, inadequate, and widening recommended - - - - 47, 117

BRERETON, C. A.:
Cost of various underground railways given by 106, 109
Scheme for main avenues from east to west and from north to south - - 35-36, 37, 38-39

Bricklayers' Arms Goods Station (S.E. and C.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - 17

Bridge House Estates Trust, expenditure on bridges 6

Bridge, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - - 15

Bridges:
Charge upon county rates for, 1902-1903 - 6
London, Chatham, and Dover Railway, in way of viaduct east and west at Ludgate Hill - 63
New bridge between Waterloo and Blackfriars Bridges preferable to widening Waterloo Bridge - - - - - - - - 64, 82-83
over Strand:
for new "Main Avenue" - - - - 38
at Wellington Street - - - - 64, 117
Swing, width of, and use of hand power objected to, more co-ordination between local authorities needed - - - 58, 117
over Thames, proposed for new "Main Avenue" 38
Scheme for remedy of traffic congestion at points of intersection by construction of, and objections to - - - - - - - 62, 64
Traffic returns - - - - - - - - 18
Tramway schemes over - - - - 79-83
see also particular names.

Brighton, London and South Coast Railway, *see* London, Brighton and South Coast Railway *under* Railways.

British Electric Traction Company, *see under* Tramways.

PAGE

Brixton Road, S.W.:
Protection from building encroachments advocated - - - - - - - - 47
Widths of street - - - - - 30, 46

Broad Sanctuary, S.W., scheme for widening 41, 117

Broad Street Goods Station (L. and N.W.R.), number of vehicles arriving at, and departing from, on one day- - - - - - - - 16

Broad Street Station (N.L.R.):
Accommodation, number of passengers dealt with per annum, and suburban services 95-96
Typical journey from Finchley to - - - 26

Brompton Railway, *see* Great Northern, Piccadilly and Brompton Railway *under* Railways.

Brompton Road, S.W.:
Scheme for widening and improving recommended - - - - 41, 42, 44, 46, 117
Traffic returns - - - - - - 41, 42, 45
Tramways along, advisable, scheme for, and necessary improvements - - 41-43, 46, 81
Width of street - - - - - - - - 42

Brussels, streets:
Remodelled - - - - - - - - - 3
Widths of - - - - - - - - 31

Buda-Pesth, streets remodelled - - - 3

Buckingham Palace Road, S.W., scheme for tramway along - - - - - - - - - 84

Buildings:
Building line:
50ft. from centre of street, recommended - 39
in Hammersmith Broadway - - - 46
in Pentonville, Euston and Marylebone Roads - - - - - - - - 39
Protection from encroachments recommended - - - - - - 47, 118
Height of, should be in proportion to width of street - - - - - - - - 32, 117
in new "Main Avenues" - - - - - 36
Objections to obstruction caused by erection of new, and more co-ordination between local authorities and regulations *re*, needed 68, 118
Probable height of, in future - - - - 33

Cabs:
Cab-ranks:
Obstruction caused by, in important streets, and difficulty of remedying 65-66
Removal from main thoroughfares, recommended - - - - - - - - 118
Probable effect of Tramways on - - - 62
Speed in "Central Area" - - - - 24, 25
Traffic Returns:
Bank - - - - - - - - 61, 62
Ludgate Circus - - - - - 61, 62
Marble Arch - - - - - - 61, 62
Piccadilly - - - - - - 61, 62
Strand - - - - - - - 61, 62

Cabs and Carriages, traffic returns - - 61, 62

Camberwell, amount paid from rates for new streets, widenings and improvements since 1856 7, 8

Camberwell Green, number of tramcars to and from Westminster Bridge - - - - - - 78

Camberwell, London and Dulwich Tramways, *see* London, Camberwell, and Dulwich Tramways, and *under* Tramways.

Cambridge Avenue, W., scheme for tramway to Harrow Road - - - - - - - - - 81

Camden Goods Station (L. and N.W.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - 16

PAGE

Candlewick, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - 15

Cannon Street, E.C.:
Traffic returns - - - - - - - - 54
Width of street - - - - - - - - 30

Cannon Street Station (S.E. and C.R.), accommodation, number of passengers dealt with per annum, and suburban services - - - 93 94

Carshalton, typical journey to London Bridge - 26

Carts and Vans, traffic returns - - - 61, 62, 67

Castle Baynard, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

Cellars, provision of, and proposed width of, under various classes of streets - - - 33-34, 117

"Central Area" of London, *see under* London.

Central London Railway, *see under* Railways.

Chancery Lane, W.C., width of street - - - 30

Charing Cross, S.W.:
New thoroughfare to Waterloo Place, proposed, to relieve traffic in - - - - - - 41
Scheme for connection of processional road in the Mall with, and advantages of 40-41, 58, 117
Speed of omnibuses from, to Bank - - - 25
Traffic returns - - - - - 51-52, 55, 57

Charing Cross, Euston, and Hampstead Railway, *see under* Railways.

Charing Cross Road, W.C.:
Made in 1887, becoming overcrowded - - 29
Scheme for tramway along - - - - 83

Charing Cross Station (S.E. and C.R.), accommodation, number of passengers dealt with per annum, and suburban services - - - 93, 94

Chatham and South Eastern Railway, *see under* Railways.

Cheap, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - - 15

Cheapside, E.C.:
Objections to use of, for east to west "Main Avenue" - - - - - - - - 37
Traffic returns - - - - - - 11, 49-50
Underground tramway scheme from Aldersgate - - - - - - - - - 83
Widths of street - - - - - - - 30

Chelsea, amount paid from rates for new streets, widenings and improvements since 1856 - - 7, 8

Chennies Street, W.C., width of street - - - 40

Child's Hill, N., tramway scheme to Marylebone and Euston Roads - - - - - - - - 84

Circuses, *see under* Streets and Roads and particular names.

City and Brixton Railway, *see under* Railways.

City and Great Northern Railway, *see* Great Northern and City Railway, *under* Railways.

City and Hammersmith Joint Railway, *see* Hammersmith and City Joint Railway, *under* Railways.

City, Hammersmith, and North-East London Railway, *see* Hammersmith, City, and North-East London Railway, *under* Railways.

City of London, *see under* London.

PAGE

City Road, E.C.:
Protection from building encroachments advocated - - - - - - - - - 46-47
Width of street - - - - - - - - 46

City and South London Railway, *see under* Railways.

City and Waterloo Railway, *see* Waterloo and City Railway, *under* Railways.

City of Westminster, *see* Westminster, City of.

Clapham Road S.W.:
Protection from building encroachments advocated - - - - - - - - - 46-47
Width of street- - - - - - - - 46

Clarges Street, W., speed of omnibuses to Bank - 25

Coal:
Cost increased by restriction of hours of delivery - - - - - - - - - 62
Duties, improvements paid out of, and re-imposition advocated- - - - - 62-63
Statistics, *re* consumption and cartage in Metropolitan Police District - - - 17-18

Cockspur Street, S.W., processional road to act as relief to traffic in - - - - - - - 40

Coleman Street, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

Commercial Road Goods Station (L.T. and S.R.), number of vehicles arriving at, or departing from, in one day - - - - - - - - 17

Constitution Hill, S.W., scheme for widening 41, 117

COOPER, ROBERT ELLIOTT, *see* ELLIOTT-COOPER, ROBERT.

Cordwainer, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - 15

Cornhill, E.C.:
Traffic:
Delays - - - - - - - 59, 61
Returns - - - - - - 49-50, 57
Widths of street - - - - - - - 30

Cornhill, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - - 15

Costermongers' stalls and barrows:
Congestion caused by, and authorised sites for, out of main thoroughfares advocated - 67, 118
in Hammersmith Road - - - - - - 46
in King's Road - - - - - - - 45

County Councils:
Expenditure on improvements during last 15 years - - - - - - - - - 6
see also particular names.

County of London, *see* London, Administrative County of.

Covent Garden Market, congestion caused by heavy traffic to, and suggestion *re* removal - - - 67

CRAWFORD, SIR HOMEWOOD, evidence referred to - - - - - - - - - 25

Cripplegate Within, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

Cripplegate Without, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

CROMPTON, LIEUTENANT-COLONEL R. E., evidence *re* traffic devoted to small goods, etc., referred to - - - - - - - - - 67

Cromwell Road, S.W., scheme for extension of, recommended - - - - - - 45-46, 117

PAGE

Croydon Corporation Tramways, worked by British Electric Traction Company, route and mileage 72, 73

Croydon and District Tramways, worked by British Electric Traction Company, route and mileage 72, 73

Crystal Palace, proposed "Main Avenue" from near, to Strand - - - - - - - - - 38

Cycles, traffic returns - - - - - 11, 61, 62

DAVISON, R. C. H., M.Inst.C.E., acknowledgment for services rendered - - - - - - 121

Deptford, amount paid from rates for new streets, widenings and improvements since 1856 - - 7, 8

Deptford, London and Greenwich Tramways, *see* London, Deptford and Greenwich Tramways, and *under* Tramways.

Devonshire House, proposed new road under Piccadilly would not affect - - - - - - - 65

Devonshire Street Goods Station (G.E.R.), number of vehicles arriving at, or departing from, on one day - - - - - - - - - - - 17

DICKINSON, W. H., length, capital, and cost per mile of certain "tube" railways as given by - 107

District Boards, expenditure on street improvements, new bridges, and widenings - - - 6

District Railway, *see* Metropolitan District Railway, *under* Railways.

DIXON, J. RUSH, evidence *re* new streets referred to - - - - - - - - - - - 38

Dowgate, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - - 15

Dulwich, Camberwell, and London Tramways, *see* London, Camberwell and District Tramways, and *under* Tramways.

DUNWOODY, R. B., Assoc. M.Inst.C.E., acknowledgment for services rendered - - - 121

Earl's Court, W., scheme for deep-level railway to Mansion House, authorised - - - 80-81

East Ham, typical journey to Fenchurch Street - 26

East Ham Urban District Corporation Tramways, route and mileage - - - - - - - 72

Eastcheap, widened 1884, but becoming overcrowded - - - - - - - - 29, 104

East London Railway, *see under* Railways.

Edgware Railway, *see* Edgware and Hampstead Railway and Watford and Edgware Railway, *under* Railways.

Edgware Road, W.:
"First-class Street" from Marylebone Road to recommended - - - - - - - 40, 117
Intersection of traffic and proposed widening at Marble Arch, to relieve - - 56, 65, 118
Protection from building encroachments advocated - - - - - - - - 46, 47
Scheme for "Third-class Street" to Farringdon Road, from - - - - - - - - 40
Speed of motor omnibuses - - - - - 25
Tramway schemes and extensions - - - 87
Widths of street - - - - - - 30, 46

"Elephant and Castle," S.E.:
to Blackfriars Bridge, vehicular traffic and points of intersection - - - - - - 53
"Main Avenue" to Holloway required - - 35
Traffic returns - - - - - - - - 53

ELLIOTT-COOPER, ROBERT, length, capital, and cost per mile of certain "tube" railways, as given by - - - - - - - - - - 107

ELLIS:
A. C., cost of Metropolitan Railway and "Inner Circle" - - - - - - - - - - 106

PAGE

ELLIS—*continued.*
SIR J. WHITTAKER:
Evidence referred to - - - - - - 39
Scheme for wide thoroughfare from Prince's Street to Waterloo Place - 41

Embankments, *see under* Thames Embankments and particular names.

Enfield:
Main road through, inadequate - - - - 47
Typical journey to Liverpool Street - - - 26

Erith Urban District Council Tramways, route and mileage - - - - - - - - - - - 73

Essex County Council, expenditure on improvements during past 15 years - - - - - 6

Euston Road, N.W.:
Building line - - - - - - - - - 39
Lengths bordered by various classes of property - - - - - - - - - - 39
Tramways:
Scheme for, to Child's Hill - - - - 84
Terminus, number of passengers per day alighting from, and joining cars at - 75
Widening, scheme for - - - - - 39-40, 117

Euston, Hampstead, and Charing Cross Railway, *see* Charing Cross, Euston, and Hampstead Railway, *under* Railways.

Euston Station (L. and N.W.R.):
Accommodation at, number of passengers dealt with per annum, and suburban services 91-92
Scheme for tramway connection - - - - 84

Factories:
Congestion caused by - - - - - - 16
Number of, close to, and within certain radius of the Bank - - - - - - - - 14
Table of, in London - - - 14, 15, 16

Farringdon Road, E.C.:
Scheme for "Third-class Street" from Edgware Road to - - - - - - - - - 40
Tramway scheme to Gray's Inn Road - - 82

Farringdon Street, E.C.;
Great Northern Goods Station, number of vehicles arriving at, and departing from, on one day - - - - - - - - - 16
Traffic:
Delays - - - - - - - - 60
Intersection - - - - - - - 58
Returns - - - - - - - - 18
Schemes for viaduct to relieve traffic congestion in - - - - - - - - - 62-63
Viaduct to Blackfriars Bridge recommended 63, 117

Farringdon Within, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

Farringdon Without, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - 15

Fenchurch Street Stations:
Great Eastern Railway, accommodation, number of passengers dealt with per annum, and suburban services - - - - - - - 93
London, Tilbury, and Southend Railway:
Accommodation, number of passengers dealt with per annum, and suburban services - - - - - - - - - 96
Typical journey from East Ham to - - 25

Finchley, N.W., typical journey to Broad Street - 26

Finchley Road, N.W., tramway scheme - - - 84

Finsbury, amount paid from rates for new streets, widenings and improvements since 1856 - - 78

Finsbury Pavement, E.C., traffic returns - - 18

PAGE

FITZMAURICE, MAURICE, C.M.G.:
Estimate of cost of "tubes" and tramway subway - - - - - - - - - 104, 105
Evidence *re* new streets referred to - - - 38
Length, capital, and cost per mile of certain "tube" railways, as given by - - - - 107
New bridge on different site preferable to complete widening of Waterloo Bridge - - 64
Objections of, to bridge over Strand at Wellington Street - - - - - - - - 64
Scheme and estimates for main avenue, north and south - - - - - - - - - 38
on subways for railways and tramways 104-105, 107-108, 109

Fleet Street, E.C.:
Traffic:
Delays - - - - - - - - 60
Intersection - - - - - - - 63
Returns - - - - - 11, 18, 51-52
Widths of street - - - - - - 30, 58

Forecourts:
Building on, should be prohibited, and acquisition of, urged - - - - - - 39, 47, 48
Irregular paving and level of unrailed private forecourts objected to, and more co-ordination between local authorities needed - - 68
Levelling and paving of unrailed, recommended - - - - - - - - 118

Forest Gate and Tottenham Railway, *see* Tottenham and Forest Gate Railway, *under* Railways.

Fountains in centre of roadway should be removed 65

FOX, SIR DOUGLAS, general estimate for "Tube" Railways - - - - - - - - 107

France, *see* Paris.

FRANCIS, SUPERINTENDENT, evidence of, referred to - - - - - - - - - - 19

Fulham:
Amount paid from rates for new streets, widenings and improvements since 1856 - 7, 8
Main road through, inadequate - - - 47

Fulham Road, S.W.:
to King's Road, Chelsea, vehicular traffic and points of intersection - - - - - - 53
Length of road bordered by various classes of property - - - - - - - - 44
Scheme for widenings - - - 41-44, 117
Traffic returns - - - - 41-42, 45, 53
Tramway along, advisable, scheme for, and necessary improvements - - 41-42, 46, 81
Widths of street - - - - - - - -

Gas and water mains, table of, in City of London - 15

General Post Office:
Metropolitan Railway from Paddington to 103-104
Traffic returns - - - - - - - - 57

Germany, *see* Berlin and Hamburg.

Glasgow:
Central Railway, cost of - - - - 106, 110
Tramways:
Ratio of mileage to population - - - 71
Lieutenant-Colonel Yorke's evidence *re* speed of, referred to - - - - 24

Golden Lane, E.C., traffic returns - - - - 18

Goodman's Yard Goods Station (G.E.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - - 16

Goods vehicles, traffic returns - - - - 11, 16

Gray's Inn Road, W.C.:
Intersection of traffic - - - - - - 56
Tramway scheme to Blackfriars Bridge - - 82

Great Central Railway, *see under* Railways

PAGE

Great Eastern Railway, *see under* Railways.

Great Northern and City Railway, *see under* Railways.

Great Northern, Piccadilly, and Brompton Railway, *see under* Railways.

Great Northern Railway, *see under* Railways.

Great Tower Street, E.C.
Traffic returns - - - - - - - 18
Widening - - - - - - 29, 104

Great Western Railway, *see under* Railways.

"Greater London," *see* Metropolitan Police District.

GREATHEAD, MR., "tube" scheme by, referred to - - - - - - - - - - 110

Green Park, sunken road from Berkeley Square to, and new road to Mall recommended - 64, 117

Greenwich, S.E.:
Amounts paid from rates for new streets, widenings and improvements since 1856 - 7, 8
Main road through, inadequate - - - 47
Number of tramcars to and from Westminster Bridge per hour - - - - - - - 78
Tramway communication with City inadequate, and scheme for improvement - - 83

Greenwich, London, and Deptford Tramways, *see* London, Deptford, and Greenwich Tramways, and *under* Tramways.

Grosvenor Place, S.W., scheme for tramway subway under - - - - - - - - - 80

Guildford Street, W.C., width of street - - - 40

Hackney, amount paid from rates for new streets, widenings and improvements since 1856 - - 7, 8

Hamburg, Tramways, ratio of mileage to population - - - - - - - - - - 71

Hamilton Place, W., congestion relieved by widening at - - - - - - - - - - 58

Hammersmith, W.:
Amount paid from rates for new streets, widenings and improvements since 1856 - 7, 8
Motor Omnibuses:
to Oxford Circus, via Holland Park Avenue, speed of - - - - - - 25
to Piccadilly Circus, speed of - - - 25
Tramways:
Scheme for, to Aldgate - - - - - 80
Terminus, number of passengers per day alighting from and joining cars at - 75

Hammersmith Bridge, scheme for tramway across 79-80

Hammersmith Broadway, W.:
to Mansion House Station:
Causes of traffic congestion - - 56-57
Vehicular traffic and points of intersection 48, 51-52, 55
Speed of electric tramcars from - - - 25
Traffic congestion at - - - - - - 25-26
Traffic returns - - - - - - - 51-52
Tramway to south side of Putney Bridge, authorised, and should be carried out - - 80

Hammersmith and City Joint Railway, *see under* Railways.

Hammersmith, City, and North-East London Railway, *see under* Railways.

Hammersmith Road, W.:
Building line - - - - - - - - - 46
Costermongers' barrows in - - - - - 46

PAGE

Hammersmith Road, W.—*continued.*
Lengths bordered by various classes of property - - - - - - - - - 43
Traffic returns - - - - - - - 42, 45
Tramway along necessary, and widening required for - - - - - - - - - 45
Width of street - - - - - - - - 46

Hampstead, amounts paid from rates for new streets, widenings and improvements since 1856 - 7, 8

Hampstead and Edgware Railway, *see* Edgware and Hampstead Railway, *under* Railways.

Hampstead, Euston, and Charing Cross Railway, *see* Charing Cross, Euston, and Hampstead Railway, *under* Railways.

Hampstead and Tottenham Railway, *see* Tottenham and Hampstead Railway, *under* Railways.

Hampstead Road, N.W., tramway scheme to Westminster Bridge - - - - - - - - - 83

Harlesden, Tramway to Harrow Road, scheme for connections and extensions - - - - - 81

HARPER, EDGAR:
Diagram of omnibus routes by - - - - 85
Division of "Greater London" into zones and sections - - - - - - - - 12-13
Evidence referred to - - - - 24, 27, 76

Harrow Road, W., Tramways:
to Cambridge Avenue, scheme for - - - 81
to Kensal Green and Harlesden, scheme for connections and extensions - - - - 81
to Paddington, scheme for extensions and connections - - - - - - - - - 81

Harrow Road and Paddington Tramways, route and mileage - - - - - - - - - 72

Hart Street, W.C., intersection of traffic - - 55

Haussman, M., street improvements laid down by - - - - - - - - - - - 3-4

Haydon Square Goods Station (L. and N.W.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - 16

Haymarket, S.W., congestion caused by cab-ranks in - - - - - - - - - - 60

HAYWOOD, COLONEL, extract from report *re* traffic of City and improvements needed - - 62

Heavy Traffic:
Large proportion of, and measures for diminishing - - - - - - - - - 67
Speed in "Central Area" - - - 24, 25

Hertford and Middlesex Light Railways, *see* Middlesex and Hertford Light Railways, and *under* Tramways.

Hertfordshire County Council, expenditure on improvements during past 15 years - - - - 6

High Holborn, W.C., traffic returns - - 49-50

Highgate Hill (cable) Tramways, route and mileage 79

Holborn, W.C., amount paid from rates for new streets, widenings and improvements since 1856 7, 8

Holborn, W.C.:
Traffic returns - - - - - - - 49-50
Tramway terminus, number of passengers per day alighting from, and joining, cars at - 75

Holborn and neighbouring streets, traffic returns 18

Holborn Circus, E.C., curved avenue to Whitechapel, question *re* - - - - - - - - 37

Holborn Hill:
Loss incurred in carriage traffic on - - 62
Steep gradient of, prior to construction of Holborn Viaduct - - - - - - - 62

PAGE

Holborn Viaduct, E.C.:
Advantages of, cost, and "recoupment" - - 62
Gross and net costs of - - - - - - 36
Objections to use of, as east to west "Main Avenue" - - - - - - - - 37-38

Holborn Viaduct Station (S.E. and C.R.), accommodation, number of passengers dealt with per annum, and suburban services - - - 93-94

Holland Park Avenue, W., speed of motor omnibuses to Oxford Circus and Hammersmith - - - 25

Holloway, scheme for "Main Avenue" to "Elephant and Castle" - - - - - - - - 35

Hyde Park, scheme for tramway subway under - 81

Hyde Park Corner, W., traffic returns - 51, 52, 55, 57

Ilford Urban District Council Tramways, route, mileage - - - - - - - - - - 72

India Docks and London Railway, *see* London and and India Docks Railway, *under* Railways.

Inner Circle Railway, *see under* Railways.

Islington, amount paid from rates from new streets, widenings and improvements since 1856 7, 8

Italy, *see* Rome.

JEFFREYS, W. REES, evidence referred to - - 39

Kensal Green, N.W., Tramway to Harrow Road, scheme for connections and extensions - - 81

Kennington, S.E., number of tramcars per hour to and from Westminster Bridge - - - - 78

Kensington, W., amount paid from rates for new streets, widenings and improvements since 1856- 7, 8

Kensington High Street, W., traffic returns - 51-52

Kensington Road, S.W.:
Lengths bordered by various classes of property - - - - - - - - - - 43
Scheme for widening and improving recommended - - - - - - - 41-43, 117
Traffic returns - - - - 41-42, 45, 51, 52
Tramway along advisable, and improvement necessary - - - - - - 41-43, 46
Widths of streets - - - - - - 42, 46

Kent County Council, expenditure on improvements during past 15 years - - - - - 7

King Street, W.:
Building line in, - - - - - - - 46
Costermongers' barows in - - - - - 46
Widening recommended - - - - - 117
Widths of streets - - - - - - - 46

King William Street, E.C., traffic delays - 59, 60

King's Cross Goods Station (G.N.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - - - 16

King's Cross Station (G.N.R.):
Accommodation at, number of passengers dealt with per annum, and suburban services - - - - - - - - - 91, 92-93
Tramway connection suggested - - - 84
Widening necessary near - - - - - 39

King's Road, S.W.:
Costermongers' barrows in - - - 45
to Fulham Road, vehicular traffic, and points of intersection - - - - - - - 53
Lengths bordered by various classes of property - - - - - - - - - - 44
Scheme for tramway to Sloane Square - 83-84
Traffic returns - - - - - - 41-42, 45, 53

PAGE

King's Road, S.W.—*continued.*
Tramways along advisable, and consequent necessity of improvement scheme - 41-43
Widening, scheme for, recommended 41, 42, 44, 45, 117
Widths of street - - - - - - 42, 45

Kingston, main road through, inadequate - - 47

Kingsway, W.C.:
Expenditure and "recoupment" - - - 36
Scheme for tramway subway under - - 37, 81
Widths of street - - - - - - - 30

KNIGHT, SIR HENRY:
Evidence of, referred to - - - - - - 39
Objection to viaduct proposed by - - 63-64
Scheme for "Third-class Street" from Edgware Road to Farringdon Road - - - - 40

Knightsbridge, S.W.:
Traffic returns - - - - - - 51-52, 57
Widths of street - - - - - - - 56

Lambeth, amount paid from rates for new streets, widenings and improvements since 1856 - - 7, 8

Lamp standards in centre of roads and at junctions objected to, and should be removed - 55, 65, 118

Land Clauses Acts, regulations *re* acquisition of property for street improvements - - - - 68

Lansdowne House, proposed sunken road to Green Park from Berkeley Square would not affect - 65

Langbourn, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - 15

Lavatories in centre of roadway should be removed 65

Lea Bridge, Leyton, and Walthamstow Tramways, route, mileage - - - - - - - - - 79

Leadenhall Market, congestion caused by position and heavy traffic to, and removal suggested- - 67

Leadenhall Street, E.C.:
Objections to use of, for east to west "Main Avenue" - - - - - - - - - 37
Traffic returns - - - - - - - 49-50

Leman Street, E., Tramway scheme to Bermondsey 83

Lewisham, amount paid from rates for new streets, widenings and improvements since 1856 - - 7, 8

Leyton, Lea Bridge, and Walthamstow Tramways, *see* Lea Bridge, Leyton, and Walthamstow Tramways, *and under* Tramways.

Light vans, speed of, in "Central Area" - - 24, 25

Lime Street, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - 15

Liverpool Corporation Tramways:
Ratio of mileage and population - - - 71
Traffic returns - - - - - - - 86-87

Liverpool Street, E.C., curved avenue to Whitechapel, via, question *re* - - - - - - 37

Liverpool Street Station (G.E.R.):
Accommodation, number of passengers dealt with per annum, and suburban services 91, 93
Scheme for tramway to - - - - - - 83
Typical journey to, from Enfield - - - - 26

Loading and Unloading:
Estimate of width of street required for - - 32
Materials for new buildings, regulations recommended - - - - - - - - - 118
Obstruction caused by, and use of ground floor of property for, recommended - 66, 118

PAGE

Local Authorities:
Estimated cost of street widenings and improvements since 1856, and during last 15 years, undertaken by - - - - - - 8
More co-ordination between, *re* subordinate matters, required - - - - - - 67-68
see also Borough Councils, County Councils, etc.

Local Government Board, speed of motor vans under regulations of - - - - - - - 25

Locomotion:
Central authority necessary - - - - - 9
"Crush-hours" - - - - - - - - - 20
Journeys per capita of inhabitants of various towns - - - - - - - - - 24, 76
Lack of unity in arrangements - - - - 1-3
London inferior to many provincial and foreign towns in means of - - - - - - - 24
Means for short-distance traffic in "Central Area" not sufficient - - - - - - 19
Overcrowding caused by lack of quick means of communication with the suburbs, and need for acceleration of - - - - - - 27
Pecuniary loss due to lack of facilities for - 5
Street improvements and widening important factors for improvement of - - - - - 29

London:
ADMINISTRATIVE COUNTY OF:
Area - - - - - - - - - - - 1
Charge upon rates for street improvements, 1902-1903 - - - - - - 6, 7
Control of, vested in various authorities and independence of - - 2
Expenditure on new streets, widenings and improvements from 1856 to 1904 - 7-9
Factories in - - - - - - 14-15, 16
Lack of unity in municipal system, and of centralised control - - - - - - 1-3
Mileage, and working of tramways in 71-74
Population - - - - - - 13, 14
Cabs, *see that title.*

"CENTRAL AREA":
Acceleration of transport from suburbs to, recommended - - - - - - 116
Congestion of streets in - - - - - 18
"Crush-hours" - - - - - - - - 20
Districts included in - - - - - - 12
Factories in - - - - - - 14-15, 16
Improvements in streets few and local during past 30 years - - - - - 29
Inefficiently served by tramways - - 19
Means for short-distance traffic not sufficient - - - - - - - 19
Omnibus traffic in - - - - - - 19
Passenger traffic returns in - - - 19
Population - - - - - - 13, 14
Proportion of traffic to and from different sections - - - - - - - 23
Railway traffic in and about - - - 19
Speed of vehicles - - - - - 24-27
Time taken to reach, from the suburbs excessive - - - - - - - 27
Tramway traffic returns - - - - 19
Typical journey from suburbs to, by railway and tramway, average time of, and need for acceleration - - - 26, 27

"Central Goods Area," table of vehicles arriving at, and departing from, chief goods stations in or near, between 7 a.m. and 8 p.m. on certain dates, 1904 - - - 16-17

CITY OF:
Amounts paid from rates for new streets, widenings and improvements since 1856 7, 8
Area - - - - - - - - - - 1
Corporation of:
Construction of Holborn Viaduct by, report on, by Colonel Haywood - 62
Shares taken in Metropolitan Railway from Paddington to General Post Office - - - - - - 103-104
Site for Bank Station of Central London Railway granted free by - - 111
Subscription to "Inner Circle," from Mansion House to Aldgate - - 104

PAGE

London:—*continued.*
CITY OF—*continued.*
Corporation of—*continued.*
Expenditure on improvements during past 15 years - - - - - - 6
Extract from Colonel Haywood's report *re* traffic of, and improvements needed - 62
Factories in - - - - - - 14-15, 16
Passenger traffic returns - - - 18-27
Population - - - - - - - 13
Tramways in proposed "Main Avenues" to serve - - - - - - - - 37
Vehicles arriving at, and departing from, chief goods stations in, between 7 a.m. and 8 p.m. on certain dates, 1904 - 16-13
Warehouses in, and near - - - 15, 16
County of, *see* Administrative County, *above.*
County Council, *see* London County Council.
Diameter covered by - - - - - - 27
Division of, into zones and districts - - 12-13
"Greater," *see* Metropolitan Police District.
Inferior to many provincial and foreign towns in means of locomotion - - - - - 24
Locomotion, *see that title.*
Metropolitan Police District, *see that title.*
Omnibuses, *see that title.*
Railways, *see that title.*
Streets and Roads, *see that title.*
Traffic, *see that title.*
Tramways, *see that title.*

London Bridge Stations:
London, Brighton, and South Coast Railway:
Accommodation at, number of passengers dealt with per annum, and suburban services - - - - - - - - 94
Typical journey from Carshalton to - - 26
South Eastern and Chatham Railway, accommodation at, number of passengers dealt with per annum, and suburban services - 93-94
Tramway connections, scheme for - - - 84

London, Brighton and South Coast Railway, *see under* Railways.

London, Brighton and South Coast, and South-Eastern and Chatham Joint Railways, *see under* Railways.

London Building Act, 1894, modification of, advocated - - - - - - - - - - 32

London, Camberwell and Dulwich Tramways, route, mileage - - - - - - - - - 72

London County Council:
Amounts paid from rates for improvements undertaken by, up to 1904 - - - - 7, 9
Arrangements *re* payment for damage caused by tunnels made by - - - - 112-113
Expenditure on street improvements during past 15 years - - - - - - - 6
Organised 1889, with jurisdiction over sanitary and other matters affecting the Administrative County of London - - - - - 2
Standard width of road required by - - 45
Street communications under control of - - 108
Tramways, *see that title.*
Use made of Michael Angelo Taylor's Act by - 63

London County Council Tramways and Improvements Act, 1904, clause *re* Westminster Bridge Tramway Terminus - - - - - - - - 82

London, Deptford and Greenwich Tramways, route, mileage - - - - - - - - - 73

London and India Docks Railway, *see under* Railways.

London and North Western Railway, *see under* Railways.

London and South Western Railway, *see under* Railways.

London and South Western, and London, Brighton and South Coast Joint Railways, *see under* Railways.

PAGE

London, Tilbury and Southend Railway, *see under* Railways.

London United Tramways Company, *see under* Tramways.

London, Walthamstow and Epping Forest Railway Act, granted 1894 - - - - - - - - 113

LOW, W. RALPH, estimates for land for new main avenues - - - - - - - - 36-37, 38

Lower Tooting, typical journeys to the Bank and Westminster Bridge - - - - - - - 26

Ludgate Circus, E.C.:
Traffic:
Delays - - - - - - - - 59, 60
Intersection:
State of - - - - - 56, 58, 63
Schemes for viaduct to remedy - 63, 64
Proportion of small goods traffic - - 67
Returns - - - - 51,-52, 55, 57, 61, 62

Ludgate Hill, E.C.:
Loss incurred in carriage traffic on - - 62, 64
Traffic:
Delays - - - - - - - 60
Intersection - - - - - - - 63
Widths of streets - - - - - - 30

MACASSEY, LYNDEN, M.A., B.Sc., LL.D., acknowledgments for services rendered to Board - 121

MACRAE, A. F., M.A., acknowledgments for services rendered as Secretary - - - - - - 121

Maida Vale, W., scheme for Tramway along, and extensions - - - - - - - - - 81

Maiden Lane Goods Station (L. and N.W.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - 15

The Mall, S.W.:
New road from Green Park to, proposed and recommended - - - - - 64-65, 117
Scheme for connection of processional road in, with Charing Cross and advantages of - 40-41, 58, 117

Manchester Tramways:
Ratio of mileage to population - - - - 71
Colonel Yorke's evidence *re* speed of, referred to - - - - - - - - - 26

Mansion House, E.C., full advantage not taken of pedestrian subways at - - - - - - - 66

Mansion House Station, E.C.:
Deep-Level Railway to Earl's Court authorised 80-81
from Hammersmith Broadway:
Causes of traffic congestion - - 56-57
Vehicular traffic and points of intersection - - - - - - - 48, 51-52, 55
Traffic returns - - - - - - 51-52, 57
Typical journey to, from Richmond - - - 27

Mansion House Street, E.C., traffic delays - 59, 61

Marble Arch:
Scheme for widening at - - - - - 65, 118
Traffic:
Intersection - - - - - - - 56
Returns - - - - 49-50, 55, 57, 61, 62
Tramway schemes:
to Shepherd's Bush - - - - - - 81
to Victoria Station - - - - - - 81

Markets:
Congestion caused by situation of, and proposed removal - - - - - - - 67
see also place names.

Marylebone Goods Station (G.C.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - - 16

PAGE

Marylebone Road, N.W.:
Building line - - - - - - - - - 39
"First-class Street" from, to Edgware Road, recommended - - - - - - - 40, 117
Lengths of, bordered by certain classes of property - - - - - - - - - 39-40
Tramways scheme - - - - - - - 84
Widening scheme for - - - - - 39, 117

Marylebone Station (G.C.R.):
Accommodation at, and number of passengers dealt with per annum - - - - - 91-92
Tramway connection scheme - - - - - 84

MATHEWS, J. DOUGLAS, evidence referred to - 39

MEIK, C. S., scheme for main avenues, north and south, east to west - - - - - 35, 36-37, 38

Metropolitan Board of Works:
Amounts paid from rates on improvements undertaken by, up to 1904 - - - - - 79
Arrangements *re* payment for damage by tunnels made by - - - - - - - 112-113
Organised in 1855 with jurisdiction over sanitary and other matters affecting Administrative County of London - - - - - - 2
Price charged Metropolitan District Railway Company for easement - - - - - - 111
Subscription to "Inner Circle" Railway from Mansion House to Aldgate - - - - - 104

Metropolitan Railway, *see under* Railways.

Metropolitan District Deep-Level Railway, *see under* Railways.

Metropolitan District Railway, *see under* Railways.

Metropolitan Electric Tramways Company, *see under* Tramways.

Metropolitan Police District:
Anomalies in, due to the number of controlling authorities - - - - - - - - 2-3
Area - - - - - - - - - - - 1
Cabs, *see that title.*
Day census in, recommended - - - 114, 116
Constitution - - - - - - - - - 2
Expenditure on improvements during past 15 years - - - - - - - - - - 6
Locomotion, *see that title.*
Mileage of railways, length of single road used by passenger trains, number of stations, area and population of - - - 99, 100, 101
New Act required, *re* acquisition of property for street improvement in - - - - - 68
Omnibuses, *see that title.*
Passenger traffic returns to and from "Central Area" - - - - - - - - - - 19
Per capita journeys - - - - - - - - 24
Population - - - - - - - - - 13
Railways, *see that title.*
Ratio of mileage of tramways to population 71, 72
Statistics *re* consumption and cartage of coal in - - - - - - - - - 17-18
Table showing approximate total local yearly passenger traffic in - - - - - - - 24
Traffic, *see that title.*
Tramways, *see that title.*

Metropolitan Railway Act for line from Paddington to General Post Office - - - - 103-104

Michael Angelo Taylor's Act:
Extension of benefits of, recommended - - 118
Full advantages of, not taken - - - - 68

Middlesex County Council, expenditure on improvements during 15 years - - - - - - 6

Middlesex and Hertford Light Railways, route and mileage - - - - - - - - - 72

Midland Railway, *see under* Railways.

Mile End Waste, E., removal of Whitechapel Hay Market to, recommended - - - - 67, 118

PAGE

Mitcham Light Railways, route and mileage - - 73

Moorgate Street, E.C.:
Tramways:
Scheme for, to Norton Folgate - - - 83
Terminus, number of passengers per day alighting from and joining cars at - - 75
Widths of street - - - - - - - 30

Moorgate Street Station, suburban services - - 97

MORTON, A. C., estimate of total number of people entering City every week-day - - - 18

Motor Car Act, 1903, speed of motor omnibuses under - - - - - - - - - - 25

MOTT, C. GREY, "tube" railway promoted by - 109

New Bridge Street, E.C.:
Schemes for viaducts from - - - 63-64
Traffic delays - - - - - - - - 60

New Cross, Tramway service to City inadequate - 83
from Westminster Bridge - - - - - - 78

New Cross Road, S.E., width of street - - - 30

New Cross Tramway service to City inadequate - 83

Newgate Street, E.C.:
Objections to use of, for east to west "Main Avenue" - - - - - - - - - 37
Proportion of traffic devoted to small goods, etc. - - - - - - - - - 67
Traffic returns - - - - - - - 49-50

New Oxford Street, W.:
Traffic returns - - - - - - - 49-50
Widths of street - - - - - - - 56

New York, *see under* United States of America.

Nine Elms Goods Station (L. and S.W.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - - 17

North East London, Hammersmith, and City Railway, *see* Hammersmith, City, and North-East London Railway *under* Railways.

North East London Railway, *see under* Railways.

North London Railway, *see under* Railways.

North Metropolitan Tramways Company, *see under* Tramways.

North and South-Western Junction Railway, *see under* Railways.

North West London Railway, *see under* Railways.

Norton Folgate, Tramway scheme to Moorgate - 83

Notting Hill Gate High Street, W., traffic returns - - - - - - - - - - 49-50

OAKLEY, SIR HENRY, evidence of, referred to 114

Offices, dwelling houses, etc., table of, in City of London - - - - - - - - - - 15

Old Kent Road, S.E.:
Bricklayers' Arms Goods Station (S.E. and C.R.), number of vehicles arriving at, and departing from, on one day - - - - 17
Number of tramcars to and from Westminster Bridge - - - - - - - - - 78
Protection from building encroachments advocated - - - - - - - - 46-47
Width of street - - - - - - - - 46

Omnibuses:
Advantages of tramways compared with 86-87
Congestion caused by - - - - 62, 85-87

PAGE

Omnibuses—*continued.*
Motor:
Indicator of application of brakes on rear, recommended - - - - - - 118
Preferable for short-distance urban traffic 34
Question *re* effect on tramway and railway policy - - - - - - - - 119
Question *re* success of - - - - - 87
Speed in "Central Area" - - - 24, 25
Numbers increased by Central London Railway - - - - - - - - - 88
Probable effect of tramways on - - - - 85
Proportion of traffic to and from "Central Area" handled by - - - - - - 22
Proposed substitution of tramways for, would not affect necessary widenings of street - 62
Speed in "Central Area" - - - - 24
Regulation *re* departure from stopping places recommended - - - - - - - 118
Routes and speed of - - - - - - - 85
Traffic Returns:
Bank, E.C. - - - - - - 61-62
Bayswater Road, W. - - - - - - 45
Central Area - - - 19, 20, 21, 22
Fulham Road, S.W. - - - - - - 45
"Greater London" - - - - - - 24
Hammersmith Broadway, W. - - - 45
King's Road, S.W. - - - - - - 45
Liverpool - - - - - - - 86-87
Ludgate Circus, E.C. - - - - - - 61
Marble Arch, W. - - - - 61, 62
Metropolitan Police district - - - 24
Piccadilly, W. - - - - - - - 61
Strand, W.C. - - - - - - - - 61
see also Returns *under* Traffic.
Want of regulation of omnibuses leaving stopping places objected to, and more co-ordination between local authorities needed - 67-68
Overcrowding caused partly by lack of quick means of communication with the suburbs - - - 27

Oxford Circus, W.:
Congestion caused by railway receiving offices in - - - - - - - - - - - 66
Motor Omnibuses:
to Hammersmith, *via* Holland Park Avenue, speed of - - - - - - 25
to Peckham, speed of - - - - - - 25
Street widening would relieve congestion at - 65
Traffic:
Intersection - - - - - - - 56
Returns - - - - - - - - 57

Oxford Street, W.:
Objections to use of, as east to west "Main Avenue" - - - - - - - - 37-38
Proposed new street from Edgware Road to Farringdon Road to act as relief to - - 40
Proportion of traffic devoted to carriage of small goods, etc. - - - - - - - - 67
Traffic returns - - - - 11, 49-50, 55, 57
Width of street - - - - - 30, 56
see also New Oxford Street.

Paddington, amount paid from rates for new streets, widenings and improvements since 1856 7, 8

Paddington Goods Station (G.W.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - - - 16

Paddington Station (G.W.R.):
Accommodation at, number of passengers dealt with per annum and suburban services - 91, 92
Metropolitan Railway from General Post Office to - - - - - - - - - - 103-4
Tramway connection with, suggested - 81, 84

Pall Mall, S.W.:
Relief to traffic in, by new processional road - 41
Traffic returns - - - - - - - - 51-2

Paris:
Metropolitan Railway leased to private company - - - - - - - - - - 3
Municipally constructed railways successful in - 65

PAGE

Streets:
Expenditure on new, widenings and improvements compared with London - 4, 9
System of improvements - - - - 3-4
Widths of - - - - - - 4, 31
System of stations on Metropolitan Railway - 112
Traffic returns - - - - - - - 24, 76

Park Lane, W.:
Scheme for widening at Marble Arch to relieve intersection of traffic - - - - - 65, 118
Width of street - - - - - - - 30

Parliament:
Acts:
1756, *re* building line in certain roads - 39
1890, Coal Duties abolished by - - - 62
1899, cessation of Wine Duties under - 62
re Acquiring portions of property for street improvements advocated - - 68, 118
Land Clauses Acts, regulations *re* purchase of property for street improvements under - - - - - - - - 68
London Building, 1894, proposed modification of - - - - - - - 32
London County Council (Tramways and Improvements) Act, 1904, clause *re* Westminster Bridge Road tramway terminus - - - - - - - 81-82
London, Walthamstow and Epping Forest Railway Act granted 1894 - - - 113
Metropolitan Railway Act for line from Paddington to General Post Office - 103-104
Michael Angelo Taylor:
Extension of benefits of, recommended - - - - - - 118
Full advantages of, not taken - - 68
Motor Car, 1903, speed of motor omnibuses under - - - - - - - 25
Speed of traction engines under - - 25
for "tube" from City to Elephant and Castle obtained 1884 - - - - 110
Bills:
Traffic Bill, 1867, delivery of coals under 62
Notice of, *re* pneumatic tubes for small parcels - - - - - - - - 67
Select Committee of House of Commons, 1873, statistics *re* cartage and consumption of coal in, given by, in 1869 - - - - - 17-18
Standing orders, width of road required by - 45

Parliament Street, S.W.:
New thoroughfare to Waterloo Place to relieve traffic in - - - - - - - - - 41
Relief to traffic in, by new processional road - 41
Tramway scheme to Putney Bridge - - 83-84

Passenger traffic, statistics of, in City - - 18-27

Passenger vehicles, traffic returns - - - - 11

PEARSON, MR., references - - - - 103, 110

Peckham, speed of motor omnibus to Oxford Circus 25

Pentonville Road, N., building line - - - 39

PERKS, R. W.:
Cost of various underground railways 106, 108, 109
Evidence referred to - - - - - - 39
Re-imposition of Coal and Wine Duties advocated by - - - - - - - - 62-63

Piccadilly, W.:
Cab-ranks in - - - - - - - - - 66
Intersection of traffic:
at Berkeley Street, scheme for relief of, by sunken road recommended - 64-65, 117
at St. James's Street, delays from, and scheme for relief of - - 60, 61, 62
Proportion of traffic devoted to carriage of small goods - - - - - - - - 57
Traffic:
Delays - - - - - - - - 59
Returns - - - 11, 51, 52, 55, 61, 62

PAGE

Piccadilly, W.—*continued.*
Widening, a relief to congestion - - 58
Widths of street - - - - - - - 30

Piccadilly Circus, W.:
Congestion caused by Railway Receiving Offices in - - - - - - - - - - 66
Motor omnibuses to Hammersmith, speed - 25
Traffic:
Intersection:
Street widening would relieve - - 65
Table - - - - - - - - 58
Returns - - - - - 15, 52, 55, 57

Piccadilly, Great Northern, and Brompton Railway, *see* Great Northern, Piccadilly, and Brompton Railway, *under* Railways.

Pimlico Road, S.W., tramway scheme along - - 84

Police:
Control of, vested in two separate authorities 2
Metropolitan Police District, *see that title.*

Poplar, amount paid from rates for new streets, widenings and improvements since 1856 - - 7, 8

Population:
"Greater London" - - - - - - - 100
Statistics of population and traffic - - 10-27
see also particular names.

Portsoken, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - 15

Poultry, E.C., traffic delays - - - - - 61

POUND, J. L., opinion *re* motor omnibuses - - 87

Prince's Street, E.C.:
Intersection of traffic - - - - - 56
Traffic delays - - - - - - 59, 60

Prince's Street, S.W.:
scheme for wide thoroughfare to Waterloo Place from - - - - - - - 41, 117

PRYKE, W. R., evidence of, referred to - - - 19

Putney, main road inadequate - - - - 47

Putney Bridge, S.W.:
Tramway schemes:
from Hammersmith Broadway over, authorised and should be carried out 79, 80
to Parliament Street - - - 83-84
Width inadequate - - - - - - 46

Queen Victoria Street, E.C.:
Congestion caused by cab-ranks in - - - 66
Omnibuses to Bank, speed of - - - - 25
Schemes for viaducts to remedy congestion in 53
Traffic:
Delays - - - - - - - 59, 60
Intersection - - - - - - - 56
Returns - - - - - - - - 11
Widths of street - - - - - - - 30
Queenhithe, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - 15

Railways:
Additional accommodation dependent on street improvements - - - - - - 102
Approximate total local yearly passenger traffic in "Greater London" - - - 24
Baker Street and Waterloo Railway:
Length, capital, and cost per mile - - 107
Mileage - - - - - - - 100, 107
Route - - - - - - - - 98
Central authority for, recommended - 9, 116
Central London Railway:
Distribution of traffic on - - - - 115
Effect on omnibus traffic - - 88

PAGE

Railways—*continued.*

Central London Railway—*continued.*
Length, capital, and cost per mile - 99, 107
Passenger traffic returns - - 19, 22, 24
Site for Bank Station granted free by Corporation of London - - - - 111
Speed in "Central Area" - - - - 24
Stations on - - - - - - - 97
Tramway connections suggested - 75, 80, 81
Typical journey by - - - - - 26

Charing Cross, Euston, and Hampstead Railway:
Mileage - - - - - - - - 100
Route - - - - - - - - 98

City and Brixton Railway, mileage authorised, but not opened - - - - - - - 100

City and South London Railway:
Destinations of passengers on - - - 115
Dividends - - - - - - - 110
Extensions authorised - 97, 98, 100, 111
Mileage and cost - - - 99, 107, 110
Passenger traffic returns - - - 19, 24, 97
Speed in "Central Area" - - - - 24
Stations on - - - - - - - 97
Typical journey by - - - - - 26

Classes of traffic on - - - - - - - 91
Daily passenger traffic to and from "Central Area" - - - - - - - - 20, 21, 22
Delays caused by attempted combination of system of urban inter-communication and communication with outer districts - - - 36
District Railway, *see* Metropolitan District Railway *below.*
East End, difficulties of providing sufficient accommodation for - - - - - 113
East London Joint Railway, mileage - - 99
East London Railway, stations on - - - 97
Edgware and Hampstead Railway:
Mileage - - - - - - - - 100
Scheme - - - - - - - 96, 98, 100
Expenditure during past twenty years - - 6
Financial difficulties of promotion and question of, by private enterprise 102-105, 108-110, 111, 114, 116
Frequent stations, effect on speed - - - 26
Glasgow Central Railway, cost of - - 160, 109

Great Central Railway:
Accommodation at Marylebone, number of passengers dealt with per annum 91-92
Mileage - - - - - - - - 99

Great Eastern Railway:
Accommodation, number of passengers dealt with per annum at Fenchurch Street and Liverpool Street, and suburban services - - - - - 92-93
Expenditure for suburban traffic - - 113
Mileage - - - - - - - - 99

Great Northern Railway:
Accommodation and number of passengers dealt with at King's Cross and York Road, and suburban services 91, 92-93
Mileage - - - - - - - - 99
Typical journey by - - - - - 26

Great Northern, Piccadilly, and Brompton Railway:
Length, capital, and cost per mile - 100, 107
Route - - - - - - - - 98
Tramway connections suggested - - 81

Great Northern and City Railway:
Description - - - - - - 97, 98
Length, capital, and cost per mile - 99-107
Passenger traffic returns - - - 19, 24, 98
Speed in "Central Area" - - - - 24
Stations on - - - - - - - - 97

Great Western Railway:
Accommodation provided at Paddington and Bishop's Road, number of passengers dealt with per annum, and suburban service - - - - - - 92
Mileage - - - - - - - - 99
Shepherd's Bush Station of C.L.R. more important than Paddington - - - 115
Subscription to Metropolitan Railway from Paddington to G.P.O. and working of by - - - - - - - 104

PAGE

Railways—*continued.*

Great Western Railway—*continued.*
Tramway connections suggested - 81, 84
Urban services - - - - - - - 97

Hammersmith and City Joint Railway, mileage - - - - - - - - - 99
Hammersmith, City, and North-East London Railway, estimate of cost - - - - 107

"Inner Circle" Railway:
Cost of - - - - - - 106, 108, 109
not a financial success - - - - 102
Financial arrangements - - - - 104
Increased rate of speed expected - - 26
Mileage - - - - - - - - 99
Passenger traffic returns - - - - 19
Speed in "Central Area" - - - - 24
Stations on - - - - - - 95, 97
Tramway connections - - - - - 81
see also Metropolitan Railway and Metropolitan District Railway *below.*

Large proportion of traffic to and from "Central Area" handled by - - - 21, 22, 23
Liverpool Overhead Railway, speed of - - 25

London, Brighton, and South Coast Railway:
Accommodation, number of passengers dealt with per annum at termini, and suburban services - - - - - - 94, 95
Mileage - - - - - - - - - 99
Tramway connections suggested - - - 81
Typical journey by - - - - - 26
Urban train services - - - - - 97

London, Brighton, and South Coast and South-Eastern and Chatham Joint Railways, mileage - - - - - - - - - 99
London, Chatham and Dover Railway, through service on - - - - - - - - - 99

London and North-Western Railway:
Accommodation, number of passengers dealt with per annum at Euston, and suburban services - - - - - 91-92
Mileage - - - - - - - - 99
Urban services - - - - - - - 97

London and South-Western Railway:
Accommodation, number of passengers dealt with per annum at termini, and suburban services - - - - - - 94
Fares - - - - - - - - - 113
Typical journey by - - - - - - 27
Urban train services - - - - - 97

London, Tilbury, and Southend Railway:
Accommodation, number of passengers dealt with per annum at Fenchurch Street, and suburban services - - - 96
Mileage - - - - - - - - 99
Typical journey by - - - - - 26

London, Walthamstow, and Epping Forest Railway, authorised, but failure of, through want of capital - - - - - - - 113

Metropolitan Railway:
Accommodation, number of passengers dealt with per annum and suburban services - - - - - - - - 95
Cost of - - - - 104, 106, 108, 109, 113
Dividends - - - - - - - 110
Electrification in progress - - - 97
Expenditure for double line - - - 37
Financial difficulties of promoting line from Paddington to G.P.O. - - 103-104
Higher rate of speed on branches - - 25
Length of original line, and cost - - 108
Mileage - - - - - - - - 99
Passenger traffic returns - - - 19, 24
Speed in "Central Area" - - - - 24
Stations on - - - - - - 96, 97
Suburban services - - - - 92-94
Through service approved - - 102, 115
Tramway connections suggested - 75, 81, 83
see also "Inner Circle" *above.*

Metropolitan District Railway:
Cost - - - - - - 37, 106, 108, 109
Dividends - - - - - - - 110
Electrification in progress - - - - 97
Expenditure for double line - - - 37
Higher rate of speed on branches - - 26
Mileage - - - - - - - 99, 100

PAGE

Railways—*continued.*

Metropolitan District Railway—*continued.*
Passenger traffic returns - - - 19, 24
Price for easement charged by Metropolitan Board of Works - - - - 111
Speed in "Central Area" - - - - 24
Stations - - - - - - 96, 97
Suburban services - - - - - 96
Through service approved - - 102, 115
Tramway connections suggested 75, 80, 81, 82, 83
see also "Inner Circle" *above.*

Metropolitan District Deep-Level Railway:
Authorised - - - - - 80-81, 98
Estimate of cost - - - - - 107
Mileage authorised but not opened - - 100

Metropolitan Extension Railway:
Accommodation, number of passengers dealt with per annum at Baker Street, and suburban services - - - - 95
Mileage - - - - - - - - 99

Midland Railway:
Accommodation, number of passengers dealt with per annum at St. Pancras, and suburban service - - - 91, 92
Mileage - - - - - - - - 99

North London Railway:
Accommodation, number of passengers dealt with per annum at Broad Street, and suburban services - - - 95-96
Authorised but not opened - - - - 100
Mileage - - - - - - - - 99
Typical journeys by, to "Central Area" - 26
Urban services - - - - - - 97

North and South Western Junction Railway mileage - - - - - - - - 99

North-West London Railway:
Authorised - - - - - - - 97
Mileage - - - - - - - - 100

Paris Metropolitan Railway:
Leased by City to private company - - 3
Station system of - - - - - 112

Question *re* effect of motor omnibuses on tramway and railway policy - - - - - 119

Receiving Offices:
Obstruction caused by, and use of ground floor for, advisable - - - - - 66
Table of, in City of London - - - 15

Returns of Passenger Traffic:
"Central Area" - 19, 20, 21, 22, 23, 24
City of London - - - - - - 19
Metropolitan Police District - - - 24
see also under names of railways.

South-Eastern and Chatham Railway:
Accommodation, number of passengers dealt with per annum at termini and suburban services - - - - 93-94
Mileage - - - - - - - - 99
Tramway connections suggested - - - 81

Stations:
Advantages of "shallow" - - - - 42
Disadvantages of frequent - - - - 112
Fewer on suburban lines, and combination of "shallow" with "tube" construction recommended - - - - - - 119
Number in City of London, Administrative County of London, and Metropolitan Police District, on completion of lines under construction - - - 100, 101
Table of, in City of London - - - 15

Suburban Traffic:
Attempted combination of long-distance traffic and, unsuccessful - - - - 91
Origin of, and destination of passengers, attempt to discover - - - 114-115
Separation from long-distance and urban services recommended - - - - 119
Services - - - - - - 91-96, 101-102
System of Metropolitan and Metropolitan District Railways best suited for - - 102
Termini system disadvantageous for - - 101
Through system advocated - 101-102, 115, 119
Variable nature on different lines - - 113

PAGE

Railways—*continued.*

Termini:
Disadvantages of system - - - - 101
Main-line - - - - - - - - 91
Relative importance and use of tramways and - - - - - - - - - 76
Scheme for remodelling - - 115-116, 119
Traffic returns - - - - - - 76
Tramway extensions to, advocated - 83, 84

Through runnings:
Advocated in preference to terminal or circular systems - - 101-102, 115, 119
Schemes for - - - - - - 102

Tottenham and Forest Gate Railway, mileage - 99
Tottenham and Hampstead Railway mileage - 99
Traffic returns - - - - - - - 18
Tramways should connect with - - - - 84
Typical journey from suburbs to "Central Area" by tramway, and, average time for, and need for acceleration - - - 26, 27

Underground:
"Shallow":
Electric:
Proposed construction under, and connections in, new "Main Avenues," and advantage of 36, 37, 117, 119
Stations to be near street level - 34
Utilisation of substructure of new streets for - - - - 33, 34
Estimates - - - - - - 106
Inflation of capital - - - 111-112
Low rate of speed on - - - - 26
Relative cost of "tubes" and - 104-114
Traffic congestion not relieved, and need for street improvements not removed by - - - - 103, 112
Tramways should connect with - - 84

"Tubes":
Construction of cheap class "Tubes" with few stations recommended - 119
Cost - - - - 107, 108, 110-114
Easements for, recommended - - 119
Expenditure for double line - - 37
Financial difficulties of promotion - 103-105, 110-114
Inflation of capital - - - - 111
Mileage of, authorised but not opened 98, 100
Origin of - - - - - - 110
Question *re* extension of - - 112, 119
Relative cost of "shallow" railways and - - - - - - 108-114
Speed of - - - - - - 24, 25
Success of - - - - - - 111
Through lines, advantages of, and scheme for - - - - 113-116
Urban inter-communication problem unsolved by - - - - - 34
see also names of Railways.

United States of America:
Chicago:
Lake Side Elevated, speed - - 25
South Side Elevated, speed - - - 25

New York:
Rapid transit - - - - - 80
Shallow underground system in - - 34
Subway, Eleveated, local, speed - 25
Subway Express, speed - - - 25
Subway system - - - - - 34

Private company system - - - - 9
Success of municipally constructed, in - 85

Urban traffic:
Problem unsolved by "tubes" - - - 29
Roadway vehicles better suited for, than trains - - - - - - - 34-35
Separation from long-distance and suburban services, recommended - - - 119
Services for - - - - - - 96-99
System of Metropolitan and Metropolitan District Railways best suited for - - 102

PAGE

Railways—*continued.*
Urban Traffic—*continued.*
Termini system disadvantageous for - - 101
Through running advocated for - - - 119
Vehicles arriving at, and departing from, the chief stations in or near the "Central Goods Area" of London between 7 a.m. and 8 p.m. on certain dates in 1904 - - - - 16, 17
Waterloo and City Railway:
Authorised and constructed - - - 111
High rate of speed owing to absence of stations on - - - - - - 26
Mileage - - - - - - - - 99
Passenger traffic returns - - 19, 24, 97
Speed in "Central Area" - - - - 24
Typical journeys by - - - - - 27
Watford and Edgware Railway:
Authorised - - - - - - - 99
Mileage - - - - - - - - 100
Scheme for - - - - - - - - 96
West London Joint Railway, mileage - - 99
West London Railway, suburban services - 95
West London Extension Junction Railway:
Mileage - - - - - - - - 99
Suburban services - - - 95
Whitechapel and Bow Railway:
Cost - - - - - - 106, 109, 110
Destination of passengers on - - - 115
Mileage - - - - - - - 99
Widenings, cost of, construction of new lines preferable - - - - - - - - 114

Raynes Park, typical journey to Bank - - - 27

Refuges, cause of traffic congestion - - - - 55

Regent Street, W.:
Intersection of traffic - - - - - - 58
Obstruction caused by railway receiving offices in - - - - - - - - - - 66
Relief to traffic in, by new processional road - 40
Widths of streets - - - - - - - 30

REYNOLDS, J. F. J., Assoc. M.Inst.C.E., acknowledgment of services rendered - - - - 121

Richmond:
Main road inadequate - - - - - - 47
Typical journeys to Mansion House and Bank 27

RILEY, W. E., evidence *re* new streets referred to 38

Roads, *see* Streets and Roads.

ROBINSON, J. H.:
Evidence *re* new streets referred to - - - 38
Suggestion *re* removal of Whitechapel Hay Market approved - - - - - - 67

Rome:
Streets remodelled - - - - - - - 3
Sunken road and tunnel in - - - - - 65

Rosebery Avenue, E.C., made 1890-1892, but becoming overcrowded - - - - - - - 29

Royal Mint Street Goods Stations (G.N.R. and M.R.), number of vehicles arriving at, and departing from, on one day - - - - - - 17

St. Andrew's Street, E.C., intersection of traffic - 56

St. James's Street, S.W., Traffic:
Delays - - - - - - - - - - 59
Intersection with Piccadilly:
Returns - - - - - - - - - - 55

St. Martin's-le-Grand, E.C., intersection of traffic 56

St. Marylebone, amount paid from rates for new streets, widenings, and improvements since 1856 - 7, 8

St. Pancras, amount paid from rates for new streets, widenings, and improvements since 1856 - 7, 8

St. Pancras Goods Station (M.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - - - 16

PAGE

St. Pancras Station (Midland Railway):
Accommodation at, number of passengers dealt with per annum, and suburban services 91-92
Tramway connection scheme - - - - - 84
Widening necessary near - - - - - 39

St. Paul's Churchyard, Traffic:
Intersection - - - - - - - - 56
Returns - - - - - - - - - 51-2

St. Paul's Station (S.E. and C. Railway), accommodation, number of passengers dealt with per annum, and suburban services - - - 93-94

Salford Tramways, ratio of mileage to population 71

Select Committee of House of Commons, *see under* Parliament.

Shaftesbury Avenue, W.C.:
Congestion caused by cab ranks in - - - 65
Intersection of traffic - - - - - 56
Made 1887, but becoming overcrowded - - 29
Widths of street - - - - - - 4, 30

"Shallow" Underground Railways, *see* Underground Railways *under* Railways.

"Shallow" Underground Tramways, *see under* Tramways.

Shepherd's Bush W.:
Tramways:
Connection with Central London Railway successful - - - - - - - 80
to Marble Arch, scheme for - - - 81
Proposed connection between London United Tramways and new "Main Avenue" tramways at - - - - 35
Terminus, number of passengers per day alighting from and joining cars at - 75
to Whitechapel:
Causes of traffic congestion on route - 54, 56-57
Vehicular traffic and points of intersection 48, 49-50, 54

Shepherd's Bush Station (C.L.R.), more important station than Paddington - - - - - - 115

Shops, table of, in City of London - - - - 15

Shoreditch, amount paid from rates for new streets, widenings, and improvements since 1856 - 7, 8

Sloane Square, S.W., tramway scheme to Victoria 84

Smithfields Goods Station (G.W.R.), number of vehicles arriving at, and departing from, in one day - - - - - - - - - - - 162

Smithfield Meat Market, E.C., congestion caused by position and heavy traffic to, and suggested removal - - - - - - - - - - 67

Snow Hill, W.C., steep gradient of, prior to construction of Holborn Viaduct - - - - 62

Somers Town Goods Station (M.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - - - - 16

South-Eastern and Chatham Joint Railway, *see under* Railways.

South-Eastern and Chatham Railway, *see under* Railways.

South-East London and Woolwich Tramways, *see* Woolwich and South-East London Tramways, and *under* Tramways.

Southend, London and Tilbury Railway, *see* London, Tilbury, and Southend Railway, *under* Railways.

South London and City Railway, *see* City and South London Railway, *under* Railways.

Southwark, amount paid from rates for new streets, widenings, and improvements since 1856 - 7, 8

PAGE

Southwark Bridge: Tramway Schemes:
across bridge - - - - - - - - 79
to Aldersgate - - - - - - - - 83
to Westminster Bridge - - - - - - 82

Southwark depôt (S.E. and C.R.), number of vehicles arriving at, and departing from, on one day 17

Spitalfields Goods Station (G.E.R.), number of vehicles arriving at, and departing from on one day - - - - - - - - - - - 17

Stafford Street, N.W., scheme for new street from, to Edgware Road - - - - - - - - 40

Stamford Street, S.E., scheme for tramway extensions and connections - - - - - - - 83

Statistics of population and traffic - - - 10-27

Statistics, *see* Tables.

Statues in centre of roadway should be removed - 68

STENNING, A. R., estimates for land for new "Main Avenues" - - - - - - - 36, 38

Stepney, amount paid from rates for new streets, widenings, and improvements since 1856 - 7, 8

Stewart's Lane Goods Station (S.E. and C.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - 17

Stoke Newington, amount paid from rates for new streets, widenings, and improvements since 1856 7, 8

Strand, W.C.:
Congestion caused by cab-rank in - - - 66
Proposed "Main Avenue" to near the Crystal Palace - - - - - - - - - 38
Scheme for bridge over, recommended - 64, 117
Traffic:
Delays - - - - - - - 59, 60
Intersection - - - - - - - 58
Returns - - - - 51-52, 55, 57, 61, 62
Widths of street - - - - - 4, 30, 33, 56

Stratford, main road through inadequate - - 47

Streatham, number of tramcars to and from Westminster Bridge - - - - - - - - 78

Streets and Roads:
Bridges over, *see that title.*
Cab ranks in, cause of obstruction, but difficulty of remedying, and recommendations *re* removal - - - - - - - 65-68, 118
Camber on, excess of, objected to, and co-ordination between local authorities needed 67-68, 118
Cellars under, advisability of, and proposed width under various classes of street - 33-34, 117
Central Authority for necessary - - 9, 116

CIRCUSES:
Enlargement and construction of new, at crossings advocated, and schemes for 65, 118
Relief to traffic intersection, but generally on too small a scale - - - - - 58
see also particular names.
Constructed to meet local needs alone - - 2
Costermongers' stalls and barrows in, obstruction caused by, and authorised sites should be provided - - - - - - - 67
Division into five classes ,description of, and recommendations, *re* - - - 32, 116-117

FORECOURTS:
Building on, should be prohibited and acquisition of, urged - - - - 39, 47, 48
Levelling and paving of unrailed, recommended - - - - - - - 118
Private, irregular paving and level of unrailed, objected to, and more co-ordination between local authorities required 68

PAGE

Streets and Roads—*continued.*
FORECOURTS—*continued.*
Enforcement of rule of footway for pedestrians recommended - - - - 118

IMPROVEMENTS AND WIDENINGS:
Additional railway accommodation dependent on - - - - - - - 102
in "Central Area," few and local during past 30 years - - - - - - - 29
Coal and Wine Duties formerly applied to 62-63
Expenditure on:
in Administrative County of London, form 1856-1904 - - - - - 7-8
Estimated cost of, undertaken by various bodies - - - - 7-8
in "Greater London" - - - - 6
Question *re* raising of, etc. - - - 5-6
Extract from Colonel Haywood's report *re* 62
Future growth to be considered - 67, 117
General scheme - - - 4-6, 29, 32
Importance of, as factor of improvement of street locomotion - - - - - 29
Lack of uniformity in, and need for systematisation of - - - - 2, 4-5
Need for, not removed by underground railways - - - - - - - - 112
Neglect to purchase land for, and recommendations *re* - - - - - 68, 118
Reasons against, in Oxford Street and Holborn Viaduct - - - - 37-38
Recommendations *re* required - - 34-48
Standard of width recommended - 46, 116
Surface tramways preferable to construction of tramway subways - - - 47
Systems in Europe and U.S.A. - - - 3-4
Traffic intersection would be relieved by - - - - - - - - 58, 59
see also Schemes *below.*

Lack of uniform system in construction or improvement owing to number of authorities having control over - - - - - - 2

LOADING AND UNLOADING:
Estimates of widths required for - - 32
Materials for new buildings, regulation recommended - - - - - - 118
Obstruction caused by, and use of ground floor for, advisable and recommended 66, 118

Neglect of rule of road by pedestrians. objections to, and more co-ordination between local authorities required - - - - - 68
Obstruction by erection of new buildings objected to, and more co-ordination between local authorities required - - - - - 68
Sanding and cleaning, insufficiency of, objected to, more co-ordination between local authorities needed, and recommendations *re* 67-68, 118

SCHEMES:
Alternative streets necessary - - - 58
General improvement scheme 4-6, 29, 32, 116-118
Improvements necessary for future growth, and to be taken in hand at once - 67, 117
New streets:
Cromwell Road extension - 45, 46, 117
Edgware Road and Farringdon Road 40
Green Park to Mall - - 64-65, 117
Inclined roads at points of intersection - - - - - - - 62
"Main Avenues" from east to west and north to south - 35-38, 79, 116, 117
Marylebone Road and Edgware Road 40, 117
Prince's Street to Waterloo Place 41, 117
Processional road in Mall to Charing Cross - - - - - 40-41, 58, 117
Sunken road under Piccadilly at Berkeley Street to Green Park 64-65, 117
Widths and widenings - - - 32-33
Viaducts:
Blackfriars Bridge to Farringdon Street - - - - - 62-64, 82, 117
Strand at Wellington Street 62-64, 117

PAGE

Streets and Roads—*continued.*

SCHEMES—*continued.*

Widenings:

Bayswater Road, W., recommended 41-43, 117
Brentford Road (High Street) - 47, 117
Broad Sanctuary, S.W. - - 41, 117
Constitution Hill, S.W. - 41, 58, 117
Euston and Marylebone Roads, N.W. 39-40, 117
Fulham and Brompton Roads, S.W. 41-44, 117
Kensington Road, S.W. - 41-43, 117
King Street, W. - - - - - 117
King's Road, S.W. - 41, 42, 44, 45, 117
at Marble Arch, W. - - - 65, 118
Need for - - - - - 46, 47, 64
Prince's Street, S.W. - - - 41, 117
for Tramways - - - 82, 83, 84
Wandsworth Road, S.W. - - - 117

Setting back frontages of places of amusement, recommended - - - - - - 118

Standards:

Lamp and electric-cable in centre, objections to and removal recommended 55, 118
at points of traffic intersection should be removed - - - - - - - 65, 118

Statues in centre of roadway should be removed - - - - - - - - - 65

Substructure, proposed accommodation for, and widths of, for cellars, subways, and electric railways - - - - 29, 32-34, 117

Subways, *see that title.*

through Suburbs, improvement necessary 47, 117

Thronging of footways before places of amusement objected to, and more co-ordination between local authorities required - - 68

Varied material used in construction of, objections to, and more co-ordination between local authorities needed, and recommendations *re* - - - - - - - 67-68, 118

Want of regulations *re* omnibus stopping places, objection to, and more co-ordination between local authorities required - 67-68

Widenings, *see* Improvements and Widenings *above.*

WIDTHS OF:

Continental and American cities - - 31
Height of buildings should be in proportion to - - - - - - - 32, 117
London - - - - - - - - - 31
Parisian, superior to London in length and width - - - - - - - 4
Traffic to be allowed, and total width necessary in various classes - - 32-33
for Tramways - - - - - 45, 84, 87
Variations in, a cause of congestion - 56

see also Widenings, *under* Schemes, *above.*

Widths of Roads *under* Tables, and names of particular roads.

see also Particular Names.

Suburbs:

Absence of controlling authority in, and consequent variation in widths of roads - 42, 46
Acceleration of means of transport to "Central Area" recommended - - - - - - 116
Local interest should not be separated from interests of London as a whole - - 46, 47
Necessity for improving roads through - - 47
Railways, *see* Suburban Traffic *under* Railways.
Roads, *see* Streets and Roads.
Typical journeys from, to "Central Area," time taken and need for acceleration - - 26-27

Subways:

Arrangements for, in proposed new streets - 29
for Mains, recommended on both sides of streets, and proposed width - - - 34, 117
Pedestrian, small use made of, at Mansion House, and further construction of, inadvisable - - - - - - - - 66-67
Railways, *see* Underground Railways *under* Railways.

PAGE

Subways—*continued.*

Tramways, *see* "Shallow" Underground Tramways, *under* Tramways.

Surrey County Council, expenditure on improvements during past fifteen years - - - - 6

Swing-bridges, width of, and use of hand-power objected to, and more co-ordination between local authorities required - - - - 68, 117

Tables:

Amounts paid out of the rates towards new streets, widenings and improvements since 1856, undertaken by Metropolitan Board of Works and L.C.C. (up to Session 1904) - 7
Approximate total local yearly passenger traffic in "Greater London" - - - - 29
Daily passenger traffic from "Central Area" (one direction only) - - - - 21, 22
Daily passenger traffic to "Central Area" (one direction only) - - - 21, 22
Estimated cost of street widenings and improvements undertaken by local authorities since 1856 - - - - - - - - 8
Expenditure on new streets in Paris, 1871-1898 4
Factories in London - - - - - - 14
Lengths of roads bordered by various classes of property:
Bayswater Road, W. - - - - - 43
Euston and Marylebone Road, N.W. - 39-40
Fulham and Brompton Roads, S.W. - - 44
Kensington Road, S.W. - - - - 43
King's Road, Chelsea, S.W. - - - 44
Population of London - - - - - 13

RAILWAYS:

Authorised and in course of construction - 100
Cost of various railways for a double line of rails, including stations - - 106-107
Mileage, lengths of single roads used by passenger trains, number of stations, area and population in "Greater London" - - - - - 99, 100, 101
Mileage of, in Metropolitan Police District, authorised but not opened - - 100

Speeds on certain electric railways - - - 25
Speeds of vehicles, tramcars and trains in "Central Area" of London - - - - 24
Traffic Returns, *see* Returns *under* Traffic.

TRAMWAYS:

Cars run per hour on routes terminating at Westminster Bridge - - - - 78
Number of passengers alighting from, or joining cars, at certain termini - - 75
Route, mileage of tramways and light railways (along public roads) wholly or mainly within "Greater London," including all lines authorised during Parliamentary Session of 1904 - - 72-73
Summary of route, mileage of tramways and light railways (along public roads) wholly or mainly within "Greater London," including all lines authorised during Parliamentary Session, 1904 - 74

Typical journeys from suburbs to "Central Area" by tramway, railway, and railway and tramway - - - - - - - 26, 27
Vehicles arriving at and departing from Chief Goods Stations in or near "Central Goods Area" of London between 7 a.m. and 8 p.m. on certain dates 1904 - - - - 16-17
Warehouses, manufactories, shops, etc., in the City of London, in three classes of rateable value - - - - - - - - - 15
Widths of new streets and widenings - - 33

WIDTHS OF STREETS:

Aldersgate Street, E.C. - - - - 30
Bayswater Road, W. - - - - - 42
Berlin - - - - - - - - 31
Brixton Road, S.E. - - - - 30, 46
Brussels - - - - - - - - 31
Cannon Street, E.C. - - - - - 30
Chancery Lane, W.C. - - - - 30
Cheapside, E.C. - - - - - 30
City Road, E. - - - - - - 46
Clapham Road, S.W. - - - - - 46

PAGE

Tables—*continued.*

WIDTHS OF STREETS—*continued.*

Cornhill, E.C. - 30
Edgware Road, W. - 30, 46
Fleet Street, E.C. - 30
Fulham and Brompton Roads, S.W. - 42
Hammersmith Road, W. - 46
Kensington Road, S.W. - 42
King's Road, Chelsea, S.W. - 42
Kingsway, W.C. - 30
Ludgate Hill, E.C. - 30
Moorgate Street, E.C. - 30
New Cross Road, S.E. - 30
New York - 31
Old Kent Road, S.E. - 46
Paris - 51
Park Lane, W. - 30
Piccadilly, W. - 30
Queen Victoria Street, E.C. - 30
Regent Street, W. - 30
Strand, W.C. - 30
Uxbridge Road, W. - 30
Vienna - 31
Washington - 31
Westminster Bridge Road, S.W. - 30
Whitechapel Road, E. - 46

Thames Embankment:

Charge upon rates for - 6
see also Victoria Embankment.

Thames River:

Bridges over, *see that title* and particular names.
Scheme for north to south "Main Avenues" to pass over - 35-38
Tramway schemes across - 75, 79-83
Traffic returns - 18

Thayer Street, W., width of street - 40

Threadneedle Street, E.C., traffic delays - 59, 61

Tilbury, London and Southend Railway, *see* London, Tilbury and Southend Railway *under* Railways.

Tooley Street, tramway terminus at - 83

Tooting, number of tramcars to and from Westminster Bridge - 78

Tottenham, main road through, inadequate - 47

Tottenham Court Road, W.:
Intersection of traffic - 56
Scheme for widening at - 39

Tramway, scheme for - 83

Tottenham and Forest Gate Railway, *see under* Railways.

Tottenham and Hampstead Railway, *see under* Railways.

Tower, Ward of, table of warehouses, manufactories, shops, etc., in - 15

Tower Bridge, erection and maintenance of - 6

Tower Hill, E.C., new street to - 104

Tower Street, *see* Great Tower Street.

Traction Engines, speed in "Central Area," and increase of, recommended - 24, 25, 118

Trafalgar Squire, W.C., new thoroughfare to Waterloo Place to relieve - 41

Traffic:

CONGESTION:
Causes:
Cab-ranks - 65-66
Centre Tramway columns, lamp-posts and refuges - 55

PAGE

Traffic—*continued.*

CONGESTION—*continued.*

Causes—*continued.*
Configuration of junctions - 56
Costermongers' stalls and barrows 26, 27
Development of railways - 29
Frequency of side roads - 56
Investigation of - 54
Lack of comprehensive plan for street improvement - 4-8
Loading and unloading of vans in streets - 66
Obstruction by lavatories, statues, fountains, and lamp pillars - 65
Omnibuses - 85
Situations of markets - 67
Railway termini - 35
Variations in class of vehicles and widths of roadway - 56
Warehouses and factories in City - 16
Effect of "season" on - 55

Remedies:
Authorised sites for costermongers' stalls and barrows - 67
Central authority - 9
Increase of tramways - 85-86
Large and important street improvements - 29
New "Main Avenues" north to south and east to west - 35-38
Road widenings and circuses at junctions - 58, 65
Use of ground floor for accommodation of vans loading and unloading - 66
see also Schemes *under* Streets and Roads.

Returns of - 59
Underground railways no relief to - 103, 112

DELAYS:
Bank, E.C. - 59, 60-61
Cornhill, E.C. - 61
Farringdon-street, E.C. - 60
Fleet Street, E.C. - 60
King William Street, E.C. - 59, 60
Ludgate Circus, E.C. - 59, 60
Ludgate Hill, E.C. - 60
Mansion House Street, E.C. - 59, 61
New Bridge Street, E.C. - 60
Piccadilly, W. - 59, 60
Poultry, E.C. - 61
Princes Street, S.W. - 59, 60
Queen Victoria Street, E.C. - 59, 68
St. James's Street, S.W. - 59
Strand, W.C. - 60
Threadneedle Street, E.C. - 59, 61
Wellington Street, W.C. - 59, 60

Extract from Colonel Haywood's report *re* - 62

Intersection of, obstructions caused by, causes and remedies suggested - 48-65

Intra-urban, classes of passengers - 71

RETURNS:
Aldersgate Street, E.C. - 18
Aldgate, E. - 18, 49, 50, 57
Aldgate High Street, E. - 11
The Bank, E.C. - 49, 50, 55, 57
Bayswater Road, W. - 11, 41, 42, 45, 49, 50
Berlin - 24
Bishopsgate Street, E.C. - 18
Blackfriars Bridge, S.E. - 53
Bridges - 18
Brompton Road, S.W. - 41, 42, 45
Central Area - 19, 20, 21, 22
Charing Cross, W.C. - 51, 52, 55, 57
Cheapside, E.C. - 11, 49, 50
City of London - 18-27
Cornhill, E.C. - 49, 50, 57
Elephant and Castle, S.E. - 53
Farringdon Street, E.C. - 18
Finsbury Pavement, S.E. - 18
Fleet Street, E.C. - 11, 18, 51, 52
Fulham Road, S.W. - 41, 42, 45, 53
General Post Office, E.C. - 57
Golden Lane, E.C. - 18
Hammersmith Broadway, W. - 51, 52, 57
Hammersmith Road, W. - 42, 45
High Holborn, W.C. - 49, 50

PAGE

Traffic—*continued.*

RETURNS—*continued.*

Holborn, W.C. - - - - - - 49, 50
Holborn and neighbouring streets - - 18
Hyde Park Corner, W. - - 51, 52, 55, 57
Kensington High Street, W. - - 51, 52
Kensington Road, W. - 41, 42, 45, 51, 52
King's Road, S.W. - - - 41, 42, 45, 53
Knightsbridge, S.W. - - - - 51, 52, 57
Leadenhall Street, E.C. - - - 49, 50
Liverpool - - - - - - - 86-87
Ludgate Circus, E.C. - - - - 51, 52, 57
Mansion House Station, E.C. - - - 57
Marble Arch, W. - - - - 49, 50, 55, 57
New Oxford Street, W.C. - - - 49, 50
Newgate Street, E.C. - - - 49, 50
New York - - - - - - 24, 76, 78
Notting Hill Gate High Street, W. 49, 50
Oxford Circus, W. - - - - - - 57
Oxford Street, W. - - - - 11, 49, 50, 57
Pall Mall, S.W. - - - - - 51, 52
Piccadilly, W. - - - - - 11, 51, 55, 57
Piccadilly Circus, W. - - - 51, 52, 55, 57
Queen Victoria Street, E.C. - - - 11
St. James's Street, S.W. - - - - 55
St. Paul's Churchyard, E.C. - - 51, 52
Shepherd's Bush, W. - - - - - - 57
Strand, W.C. - - - - - 51, 52, 55, 57
River Thames - - - - - - - 18
Tower Street, S.E. - - - - - - 18
Total number of passenger journeys per head per annum of population - 23, 24
Uxbridge Road, W. - - - - - 49, 50
Variation in, inward and outward - - 22
Victoria Embankment, S.W. - - 11, 18
Waterloo Place, S.W. - - - 51, 52
Wellington Street, W.C. - - - - 55
Whitechapel, E. - - - - - - 57
Whitechapel High Street, E. - - 49, 50, 57

Statistics of population and traffic - - 10-27

Table of vehicles arriving at, and departing from, the Chief Goods Stations in or near the "Central Goods Area" of London between 7 a.m. and 8 p.m. on certain dates in 1904 16-17

Urban, for short distances, surface tramways most suitable - - - - - - - - 71

Tramways:

Advantages of, compared with omnibuses - 86-87
Approximate total local yearly passenger traffic in "Greater London" - - - - - - 24
Barking Town Urban District Council (Light Railway), route and mileage - - - - - 72
Beckenham Urban District Council Tramways, route and mileage - - - - - - - 73
Bexley Urban District Council Tramways, route and mileage - - - - - - - 73
British Electric Traction Company, lines leased or worked by - - - - - - 72, 73
"Central Area" inefficiently served by - - 19
Central Authority for, suggestions *re* - 9, 84-85, 116
Character and system of control in provincial towns - - - - - - - - - 71
Cost and capital value - - - - - - 78
Cross-shunting objected to - - - 76, 77
Crossings better than junctions - - 80, 118
Croydon Corporation Tramways:
Route and mileage - - - - - 72, 73
Worked by British Electric Traction Company - - - - - - - - 72
Croydon and District Tramways, worked by British Electric Traction Company, route and mileage - - - - - 72, 73
Daily passenger traffic to and from "Central Area" - - - - - - - - - 20, 21, 22
Defects of system - - - - - - - 76-77
Division of, into three sections, length of lines, control, etc. - - - - - - - 71-74
East Ham Urban District Corporation Tramways, route and mileage - - - - - - 72
Effect on omnibuses - - - - - - - 85

ELECTRIC:

Indicator of application of brakes necessary on rear of - - - - - - 26, 118
Maximum speed of - - - - - - 25-26

PAGE

Tramways—*continued.*

ELECTRIC—*continued.*

Speed in "Central Area" - - - - - 24
Surface, best means of transit for short-distance traffic - - - - - - - 71
Erith Urban District Council Tramways, route and mileage - - - - - - - - - 73
Essex, proposed connection with, in new "Main Avenue" - - - - - - - - - 25
Extensions and improvements not to wait for construction of "Main Avenues" - - 79-84 as Feeders to railways.
Harrow Road and Paddington Tramways, route and mileage - - - - - - - - - 72
Highgate Hill (cable) Tramways, route and mileage - - - - - - - - - - 79
Ilford Urban District Council Tramways, route and mileage - - - - - - - - - 72
Lack of connection between different sections - 75
Lea Bridge, Leyton and Walthamstow Tramways, route and mileage - - - - - - 79
London, Camberwell and Dulwich Tramways, route and mileage - - - - - - - 73
London County Council:
Lines owned or worked by and mileage 71-74
Proposed connection with tramways in new "Main Avenue" - - - - - 35
Route and mileage - - - - 72, 73
London, Deptford and Greenwich Tramways, route and mileage - - - - - - - - 73
London United Tramways:
Minimum speed on lines - - - - - 25
Proposed connection with tramways in new "Main Avenue" - - - - - 35
Metropolitan Electric Tramways Company, lines worked by and mileage - - - 71-72
Middlesex and Hereford Light Railways, route and mileage - - - - - - - - 72
Mileage, ratio of, to population in various towns - - - - - - - - - - 71
Mitcham Light Railways, route and mileage - 73
Municipal ownership and leasing to companies for working advocated - 84-85, 119
New streets for, through London - - - - 29
North Metropolitan Tramways Company, lines worked by, route and mileage - - 71-72
Number of cars run per hour in London and in U.S.A. - - - - - - 76, 78, 80
Probable effect on traffic - - - - - 87
Proportion of traffic to and from "Central Area" handled by - - - - - - 21, 22
Proposed substitution for omnibuses would not affect street widenings - - - - 62
Question *re* effect of motor omnibus on railway and tramway policy - - - - - 119
Railway connections recommended - 80, 81, 83, 84, 88, 118
Remedy for traffic congestion - - - - 85
Removal of centre columns recommended - 55, 65, 118

SCHEMES:

Albert Bridge, S.W. - - - - - - 79
Aldersgate to Cheapside extensions - - 83
Bayswater Road, W. - - - - - - 41
Bermondsey to Leman Street, E. - - 85
Blackfriars Bridge - - - - - - 79
Brompton Road, S.W. - - - - - 41
Cambridge Avenue and Harrow Road, W. 81
Child's Hill, N., to Marylebone and Euston Roads, N.W. - - - - - - - - 84
Connection with Middlesex Light Railway 84
Edgware Road and Maida Vale, W. - - 81
Extension and junctions - - - 79, 118
Farringdon Road, E.C., to Gray's Inn Road, W.C. - - - - - - - - 82
Fulham and Brompton Roads, S.W. - 41, 81
Hammersmith to Aldgate - - - 80-81
Hammersmith Bridge - - - - 79, 80
Hammersmith Road, W. - - - - - 46
Kensington Road, W. - - - - - 41
King's Road, Chelsea, S.W. - - - - 41
Main avenues from east to west and north to south - - - - - - - 35-36, 79
Marylebone and Euston Roads, N.W. - 84
Moorgate to Norton Folgate - - - 83
Paddington and Harrow Road, W. - - 81

PAGE

Tramways—*continued.*

SCHEMES—*continued.*

Putney Bridge - - - - - - 79, 80
Putney Bridge to Parliament Street - 83-84
Shepherd's Bush and Marble Arch - - 81
Southwark Bridge - - - - - - 79
over Thames - - 79, 80, 81, 82, 83, 118
Upper Baker Street, N.W. - - - - - 84
Uxbridge Road, W. - - - - - - 81
Vauxhall Bridge - - - - - 79, 81
Victoria Bridge - - - - - - 79
Victoria to Marble Arch - - - - - 81
Westminster Bridge - - - - - - 79
Westminster Bridge Road to Hampstead Road - - - - - - - - 83
Westminster Bridge to Waterloo, Blackfriars, and Southwark Bridges - 81-82
York Road and Stamford Street - - 83

"SHALLOW" UNDERGROUND:
Cost compared with "tube" railways 105, 108
Estimates - - - - - - - - - 103
from Kingsway under the Thames - - 81
Proposed accommodation for under streets, and scheme for - - - 29, 32-34
Street widenings with surface tramways less costly than - - - - - - 47

Space occupied by lines not to be reckoned in settling widths of streets - - - 32-33
Speed in "Central Area" - - - - - 24
Surface, advisable for short-distance urban traffic - - - - - - - - - - 34

TABLES:
Number of cars run per hour on routes terminating at Westminster Bridge - 78
Route, mileage of - - - 72, 73, 74

Through communication advocated - 79, 84-85
Typical journeys from suburbs to "Central Area" by railways, and average time and need for acceleration - - - - - 26, 27

TERMINI:
Objections to system of dead-end, and proposed extensions to remedy - 76, 77-97
Relative importance and use of railway termini and - - - - - - - 76
Schemes for elimination of dead-end - 82, 83
Table of number of passengers alighting from or joining cars at certain, per day 75
Traffic returns - - - - - - 75, 76

TRAFFIC RETURNS:
in "Central Area" - - - - - - 91
Liverpool Corporation Tramways - 86-87
Metropolitan Police District - - - 24
on Routes terminating at Westminster Bridge - - - - - - - - 78
Termini - - - - - - - - 82
Variation in, inward and outward - - 22

Universal running powers and elimination of variation of ownership recommended - - 118
Urban short-distance traffic accommodated by surface tramways better than by railways - 71
Walthamstow Urban District Council Tramways, route, mileage - - - - - - 7, 8
West Ham Corporation Tramways, route and mileage - - - - - - - - - 72
Widening of road for, better than subways - 45
Widths of streets for - - - - - 84, 87
Woolwich and South-East London Tramways, route and mileage - - - - - - - 73

Tubes for Mails, system of pneumatic in U.S.A., and proposed use of, for small parcels - - - 67

"**Tubes.**" *see under* Underground Railways, *under* Railways.

Tunnels, charge upon rates for, 1902-1903 - - 6

Underground Railways, *see under* Railways.

United States of America:
Boston, streets constructed and widened - - 3
Central authority for control of railways and tramways in - - - - - - - - 9
New York:
Per capita journeys - - - - - 24

PAGE

United States of America—*continued.*

New York—*continued.*

Streets:
Constructed and widened - - - 3
Widths of - - - - - - - 31
Tramways:
Ratio of mileage to population - - 71
Traffic returns - - - - 76, 78
Lieutenant-Colonel Yorke's evidence *re* speed of, referred to - - - 26
Private enterprise assisted by municipal credit 3
Use of pneumatic tubes for mails in - - 67
Washington, widths of streets - - - - 31

Upper Baker Street, N.W., Tramway scheme - 84

Upper George Street, W., width of street - - 40

URBAN TRAFFIC, *see under* Railways.

Uxbridge Road, W.:
Scheme for Tramways along - - - - 81
Traffic returns - - - - - - 49, 50
Widths of streets - - - - - - - 30

Vauxhall Bridge, S.W., scheme for tramway over 79, 81
Vauxhall Bridge Road, S.W., tramway, scheme for connection with railways - - - - 81

Vauxhall Station: tramway:
Connection proposed - - - - - 84
Terminus, number of passengers per day alighting from and joining cars at - - 75

Vestries, expenditure on street improvements, new bridges and widenings - - - - - - - 6

Viaducts:
Holborn Viaduct, *see that title.*
Schemes for - - - - - - 62-64, 82, 117

Victoria Bridge, scheme for Tramway over - - 79

Victoria Embankment:
Schemes for Tramway extensions - - 81, 82
Traffic returns - - - - - - 11, 18

Victoria Station:
G.W.R. suburban services - - - - 92
L.B. and S.C.R. accommodation, number of passengers dealt with per annum, and suburban services - - - - - - - - 95
New processional road to form access to - - 41
S.E. and C.R. accommodation, number of passengers dealt with per annum, and suburban services - - - - - - - - 95
Tramway:
Connections suggested - - - - 81
to Marble Arch, scheme for extensions - 81

Victoria Street, S.W.:
Congestion caused by cab-ranks in - - - 66
Forecourts built over - - - - - 77
Open areas in, covered over - - - - 68
Relief to traffic in, by new processional road - 41
Scheme for tramway along - - - - 87
Widening scheme - - - - - - 77

Vienna, streets:
Remodelled - - - - - - - - 3
Widths of - - - - - - - - 31

Vintry, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - - 15

Walbrook, Ward of, table of warehouses, manufactories, shops, etc., in - - - - - - - 15

Walthamstow, Lea Bridge and Leyton tramways, *see* Lea Bridge, Leyton and Walthamstow Tramways, and *under* Tramways.

Waltham Urban District Council Tramways, route, mileage - - - - - - - - 7, 8

PAGE

Wandsworth:
Amount paid from rates for new streets, widenings and improvements since 1856 - 7, 8
Number of tramcars to and from Westminster Bridge - - - - - - - - - 78

Wandsworth Road, S.W., improvement needed and recommendation *re* - - - - - - 46, 117

Warehouses:
Congestion caused by - - - - - - 16
Loading and unloading of vans should take place on ground flour of - - - - 66, 118
Table of, in City of London - - - - - 15

Washington, *see under* United States of America.

Waterloo and Baker Street Railway, *see* Baker Street and Waterloo Railway, *under* Railways.

Waterloo Bridge, S.W.:
Objections to widening - - - - - - 64
Tramway scheme to Westminster Bridge Road, 81-82, 83
Waterloo and City Railway, *see under* Railways.

Waterloo Place, S.W.:
Scheme for wide thoroughfare from Prince's Street to - - - - - - - 41, 117
Traffic returns - - - - - - - 51, 52

Waterloo Road, S.E., scheme for tramway extensions and connections - - - - - - - 83

Waterloo Station (L. and S.W.R.):
Accommodation, number of passengers dealt with per annum, and suburban services - 94
Tramways:
Connection, proposed - - - - - - 84
Terminus, number of passengers per day alighting from and joining cars at - 75

Watford and Edgware Railway, *see under* Railways.

Wellington Street, W.C.:
Intersection of traffic and scheme for bridge to remedy - - - - - 56, 58, 64, 117
Traffic:
Delays - - - - - - - 59, 60,
Returns - - - - - - - - 55

West Ham Borough Corporation, expenditure on improvements during past 15 years - - - 6

West Ham Corporation Tramways, route and mileage - - - - - - - - - 72

West London Extension Junction Railway, *see under* Railways.

West London Joint Railway, *see under* Railways.

Westminster Bridge, S.W.:
Tramways:
Scheme for, across - - - 79, 81, 82
Terminus:
Number of passengers per day alighting, from, and joining, cars at - 75
Obstruction caused by, and clause in London County Council (Tramways and Improvements) Act, 1904, *re* 81-82
Table of numbers of cars run per hour on routes to - - - - - - 69
Traffic returns - - - - - 82
Typical journey to - - - - - - 26
Widening advisable - - - - - 82

PAGE

Westminster Bridge Road, S.W.:
Tramway schemes from - - - 81, 82, 83
Widths of street - - - - - - - 30

Westminster, City of:
Amount paid from rates for new streets, widenings and improvements since 1856 - - - 7, 8
Corporation, expenditure on improvements during past 15 years - - - - - - 6
Scheme for widening of Princes Street, proposed by officials of - - - - - - 41

Whitechapel, E.:
Curved avenue to Holborn Circus, question *re* - 37
Proposed "Main Avenue" to Bayswater Road 35-37
from Shepherd's Bush:
Causes of traffic congestion on - - 56, 57
Vehicular traffic and points of intersection 48, 49-50, 54
Whitechapel and Bow Railway, *see under* Railways.

Whitechapel Hay Market, congestion caused by position and heavy traffic to, and removal recommended - - - - - - - - - 67, 118

Whitechapel High Street, E., traffic returns - 49, 50, 57
Whitechapel Road, E.:
Protection from building encroachment advocated - - - - - - - - - 46-47
Widths of streets - - - - - - - 46

Whitecross Street Goods Station (Midland Railway), number of vehicles arriving at, and departing from, in one day - - - - - - 16

Whitehall, S.W.:
Scheme for tramway along - - - - - 83
Widths of street - - - - - - - 32

Willesden, N.W., tramways:
to Harrow Road, authorised extension - - 81
to Vauxhall Bridge, scheme for - - - 81

Willow Walk Goods Station (L.B. and S.C.R.), number of vehicles arriving at, and departing from, on one day - - - - - - - - 17

Wine duties, improvements paid for out of, and re-imposition advocated - - - - - 62-63

Woolwich:
Amount paid from rates for new streets, widenings and improvements since 1856 - 7, 8
Ferry, charge upon rates for, 1902-1903 - - 6
Main road through, inadequate - - - 47

Woolwich and South-East London Tramways, route and mileage - - - - - - - - - - 73

Working Classes, deficient means of locomotion a cause of pecuniary loss to - - - - - - 5

WREN, SIR CHRISTOPHER, plan for rebuilding the City of London ignored - - - - - - 4

York Road Station (G.N.R.), accommodation, number of passengers dealt with per annum, and suburban services - - - - - - - 92-93

York Road Tramway, scheme for connections and extensions - - - - - - - - - 83

YORKE, LIEUT.-COLONEL, evidence on speed of tramways referred to - - - - - - - - 26

YOUNG, ANDREW, estimates for land for new "Main Avenues" - - - - - - - 36, 38

BIBL. LONDIN. UNIV.

8 NOV 1967